Harlequin Duck Surveys in Western Montana: 1995

A Report to:

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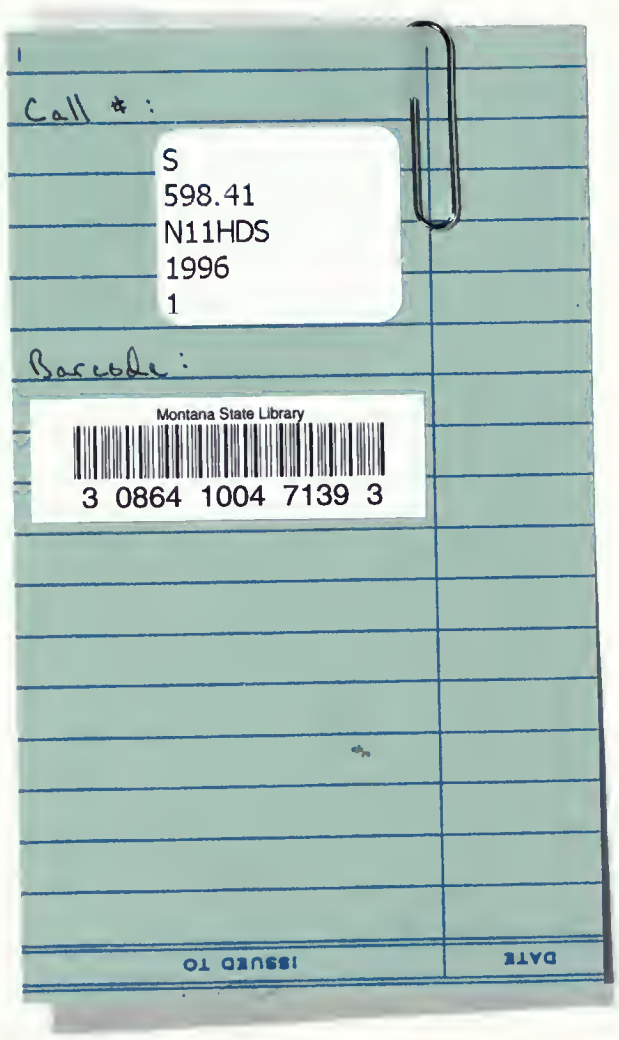

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ABSTRACT

In 1995, Harlequin Duck pair surveys were conducted on 329 km of 22 streams finding a minimum of 37♂ and 23♀. A sex ratio of 1.51:1 (m:f, n =600) was observed during 1974-1975 and 1989-1995 Montana pair surveys. Brood surveys were conducted on 371 km of 23 streams yielding a minimum of 16♀, 40 juveniles, and 2 unknowns. Harlequins were reported on 19 additional streams. Breeding was confirmed for the first time on both the Middle Fork of Rock Creek, Deerlodge National Forest (Ben Canard pers. comm.) and the West Fork of the Yaak River, Kootenai National Forest in 1995. John Gangemi observed six female Harlequins in June 1995 on the Wigwam River, just north of the U.S./Canada border in Alberta, indicating for the first time that this stream has a breeding population. Though breeding was observed in 1990 on Big Creek (Koocanusa) and Trout Creek (Superior), no birds were seen during 1995 pair surveys. Likewise ducks were seen in 1988 on Quartz Creek but not during this year's survey. A minimum of 151 pairs of ducks nest in Montana representing an estimated 198 total pairs; there are currently 33 Harlequin Duck EOs and 32 streams, surveyed 0-5 times each, where Harlequin Ducks have been observed or reported but on which the breeding status is unknown.

Reproductive success, on streams surveyed both for pairs and broods in 1995, averaged 0.23 broods per female; average brood size at or near fledging (Class III) was 3.82. In Montana during 1974-1975 and 1989-1995, annual numbers of ducklings fledged per adult female averaged 1.39 and ranged from 0.13 - 3.15 (n=305 adult females). Brood size (IIb to fledging) averaged 3.59 and ranged from 2.00 - 5.86 (n=118 broods). The proportion of females successfully raising a brood in a single year varies widely between years. In Montana, stream surveys between 1974 and 1995 found 305 females raising 118 broods, for an average of 38.7% (range 7-55%).

We continued banding Harlequin Ducks in the Flathead and Clark Fork drainages. During 1995 in Montana, 10 adult males, 12 adult females, and 35 juveniles were captured and banded on 7 streams, bringing the total number banded since 1991 to 249 (39 males, 53 females, 157 juveniles). Adult males returned to their breeding streams from the previous year on 53% (n=51) of occasions, while females returned at a rate of 57% (n=81).

A minimum of 24 birds banded in Montana have been sighted in Oregon (2), Washington (1), and southern British Columbia (21), including Vancouver Island and Hornby Island. Sexes and ages at banding show the following numbers and percentages observed: adult females (6, 11%), adult males (2, 5%), juvenile females (9, 7%), and juvenile males (7, 5%).

In Montana and Idaho, several relatively long-distance movements have been documented both within and between years. Two males and several breeding females were observed using different nearby drainages during different years, indicating that movements within a drainage of up to 30 km may regularly, but rarely, occur.

Of 100 ducklings marked in 1992-93 in Montana, 14 females are known to have survived at least 2 years; of these, 5 were reported only from their natal stream, 1 only from the coast, and 8 from both the coast and the natal breeding stream. Seven males marked as juveniles were seen only on the coast; none have been reported from their natal stream.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The Harlequin Duck (*Histrionicus histrionicus*) is a small sea duck, which travels inland to breed on fresh water streams. Harlequins breed in western North America from Alaska and the Yukon south through western Montana to California (Harlequin Duck Working Group 1993); in eastern North America, they breed from Baffin Island south to eastern Quebec and Labrador (Goudie 1993). In the Palaearctic, they breed in Iceland, Greenland and Siberia (A.O.U. 1983). Approximately 110-150 pairs of Harlequins currently breed in Montana (Reichel and Genter 1994), with most located in the following areas: 1) tributaries of the lower Clark Fork River; 2) tributaries of the North, Middle, and South Forks of the Flathead River; 3) streams coming off the east front of the Rocky Mountains; and 4) the Boulder River (Miller 1988, 1989; Kerr 1989; Carlson 1990; Fairman and Miller 1990; Diamond and Finnegan 1992, 1993; Reichel and Genter 1993, 1994, 1995).

During the breeding season, Harlequins are found along fast mountain streams (Bengtson 1966). In many areas, Harlequins use streams with dense timber or shrubs on the banks (Cassirer and Groves 1990), but they are also found in relatively open streams along the east slopes of the Rocky Mountains, Montana (Markum and Genter 1990, Diamond and Finnegan 1992), and in the Arctic tundra (Bengtson 1972). In Idaho, 90% of observations occurred near old growth or mature timber stands (Cassirer and Groves 1990). Mid-stream rocks, logs, islands, or stream-side gravel bars serve as safe loafing sites and appear to be important habitat components.

Most of the ducks arrive on their inland breeding areas in mid-April to early-May; unmated males typically arrive before pairs (Kuchel 1977). The males return to the coast shortly after the females begin incubation; most are gone by early July (Kuchel 1977). The females and young remain on the streams until August or early September. This chronology is influenced by elevation and by the timing of spring runoff; it may vary up to several weeks between years.

The U.S. Forest Service, Region 1, lists the Harlequin Duck as Sensitive (Reel *et al.* 1989). The species is listed as a Species of Special Concern by the Montana (Montana Natural Heritage Program 1994) and Idaho (Idaho Conservation Data Center 1994) Natural Heritage Programs. The eastern North American population is listed as Endangered in Canada (Goudie 1993).

The Montana Natural Heritage Program began surveying Harlequin Ducks in 1988. The survey data gave rise to questions involving site fidelity, productivity and mortality. We began individually marking Harlequins to a limited extent in 1991; through 1994, a total of 192 Harlequins were marked on 9 streams, representing the largest population of marked Harlequins from breeding streams. Birds marked in Montana have subsequently been captured and observed on the coasts of Oregon, Washington and British Columbia, with most reports coming from Vancouver Island. Long term goals include: 1) developing a baseline status report of current and historic Harlequin populations in Montana; 2) gathering information on site fidelity, reproduction and mortality to allow estimations of what constitutes a viable Harlequin population; 3) developing survey protocols for actual and potential Harlequin streams; 4) developing management guidelines for maintaining and restoring Harlequin populations and habitat; and 5) identifying coastal areas where Harlequins from the Northern Rockies occur. Goals for 1995 included: 1) surveying additional streams for presence and status of Harlequins; 2) gathering productivity data on some primary Harlequin streams; 3) marking as many individuals as possible on selected streams for long-term monitoring; and 4) summarizing distribution, population, movement, and survey data from Montana.

METHODS AND MATERIALS

Harlequin Ducks were surveyed on parts of the Kootenai, Helena, Custer, Flathead, and Lolo National Forests and on the Stillwater State Forest during May-August 1995 (see Appendix C). Data sheets used are shown in Appendix A. We also marked birds in Glacier National Park; surveys there were conducted primarily by Park Service personnel (Ashley 1994a, 1994b). Most surveys were conducted by walking the stream channel (when possible) or stream bank. In most cases, the surveyor walked upstream, giving more time to observe the bird before it moved out of sight. Some larger streams were surveyed partially or completely by kayak. Dates, locations, distance surveyed, and general characteristics of the stream reaches surveyed were recorded; any Location, numbers, ages, and sex of all Harlequins seen was recorded, as were habitat characteristics of the site. For streams in the Flathead and Clark Fork drainages, we attempted to capture and mark all birds seen when a licensed, qualified bird-bander was present on the survey (Reichel, Genter, or Hendricks). Captured birds were sexed, aged, weighed, measured (wing cord and tail), marked, and released. Except in Glacier National Park, all adult birds were marked with numbered USFWS aluminum leg bands and with colored nasal discs, which are individually recognizable by shape and color combination. Adults only in Glacier National Park, and all juveniles, were banded with a USFWS aluminum band and with a blue, plastic leg band with 2 white alpha-alpha or alpha-numeric characters.

SURVEYS AND BANDING

MONTANA SURVEYS - 1995

In 1995, Harlequin Duck pair surveys were conducted on 329 km of 22 streams, yielding a minimum of 37♂ and 23♀. Brood surveys were conducted on 371 km of 23 streams yielding a minimum of 16♀, 40 juveniles, and 2 unknowns.

Kootenai National Forest. Pair surveys were conducted along 163 km of 11 streams during April-May 1995 (Appendix C). A minimum of 29 Harlequins (19 males, 10 females) were seen on 6 streams (Appendix C). These included Callahan Creek (1♂), Grave Creek (4 pairs), Marten Creek (3 pairs plus 3♂), Rock Creek (2♂), Swamp Creek (3 pairs plus 1♂), and the Vermilion River (3♂). No birds were seen on Quartz Creek, the Kootenai River at Kootenai Falls, or Big Creek (Koocanusa) though birds had bred there previously (see DISTRIBUTION - HISTORICAL CHANGES).

Brood surveys were conducted along 190 km of 13 streams during July 1995 (Appendix C). A minimum of 49 different Harlequin Ducks were observed on 6 streams (Appendix C). Callahan Creek had 1♀ present. Grave Creek had 2♀ present with broods of 1 and 4 chicks; 2 unknowns were also seen. Marten Creek had 4♀ present with 2 broods of 5 and 6 chicks. Rock Creek had 1♀ present with a brood of 5 chicks. Swamp Creek had 2♀ present, each with a brood of 5 chicks. The Vermilion River had a minimum of 3♀ present with 2 broods of 3 and 2 chicks; additionally, a female and her brood marked the previous day on Marten Creek were also seen (see MOVEMENT - ON THE BREEDING GROUNDS). Breeding was noted for the first time on the West Fork of the Yaak River where 1♀ had a brood of 2.

Helena National Forest. Pair surveys were conducted along 56 km of 3 streams during May 1995 (Appendix C). No Harlequin Ducks were observed on any stream (Appendix C);

however, a pair was seen on the East Fork of the Blackfoot River on the Lolo NF, just east of the Helena NF.

Other Northwest Montana Areas. Pair surveys were conducted along 110 km of 8 streams during May 1995 (Appendix C). A minimum of 31 Harlequins (18 males, 13 females) were seen on 6 streams (Appendix C). These included the East Fork of the North Fork Blackfoot River (1 pair), North Fork Blackfoot River (4 pairs), Spotted Bear River (1♂), Sullivan Creek (1 pair plus 1♀ and 1♂), Swift Creek (2♂), and Trail Creek (6 pairs plus 2♂). No birds were seen on Trout Creek (Superior) where birds are known to have bred as recently as 1990 (see DISTRIBUTION - HISTORICAL CHANGES).

Brood surveys were conducted along 86 km of 5 streams during July - August 1995 (Appendix C). A minimum of 8 different Harlequin Ducks were observed on 2 streams (Appendix C). These included the Spotted Bear River (2♀, 1 brood of 5 young) and Sullivan Creek (1♀). Trail Creek with six pairs in the spring apparently did not produce any young (see CAUSES OF MORTALITY).

Other Southwest Montana Areas. Brood surveys were conducted along 95 km of 5 streams during early August 1995 (Appendix C). No Harlequin Ducks were observed on any stream (Appendix C).

Surveys by Others. Additional surveys were conducted by Glacier National Park (Ashley 1995), on the Boulder River by the Deerlodge National Forest (Jim Sparks pers. comm.), and the Lewis and Clark National Forest (Portia Jelinek, pers. comm.). Locations of birds seen on Forest Service surveys are reported in Appendix E. Reproductive parameters and movements discussed later in this report include data from Ashley (1995 and pers. comm.).

SUMMARY OF MONTANA SURVEYS 1987-95

In Montana, 2963 km of streams have been surveyed since 1987 (Figure 1, Appendix G). Many of these stream reaches have been surveyed in multiple years and during both pair and brood season (Appendix G). Not all of these streams can be considered adequately surveyed. To be reasonably sure birds are not present on a stream where no previous sightings have occurred, at least two surveys should be conducted during the period 1-25 May. Due to lack of knowledge of proper survey timing, many surveys done prior to 1992 were done during June (after males have left and females are incubating) or after 10 August when many birds have left all but the streams in southwest Montana. The areas most likely to have ducks present, which need primary or additional surveys performed, are given in Appendix B.

BANDING IN MONTANA: 1991-95

During 1995 in Montana, 10 adult males, 12 adult females, and 35 juveniles were captured and banded (Table 1). This brings the toal number banded since 1991 in Montana to 249 (39 males, 53 fmales, 157 juveniles).

Table 1. Summary of harlequin ducks marked in 1995, not including birds marked in previous years and recaptured in 1995 (total ducks captured in all years including 1995 are in parentetheses).

Location	Male	Female	Juv.	Total
McDonald Creek, Glacier NP	8 (15)	6 (28)	1 (51)	15 (94)
Trail Creek	(7)	(5)	(14)	(26)
Grave Creek		(1)	(4)	(5)
Spotted Bear River		1 (3)	5 (15)	6 (18)
Sullivan Creek, Flathead Co.		1 (1)	(6)	1 (7)
Marten Creek, Sanders Co.	2 (13)	(6)	11 (30)	13 (49)
Rock Creek, Sanders Co.	(3)	1 (4)	5 (11)	6 (18)
Swamp Creek, Sanders Co.		2 (2)	10 (11)	12 (13)
Vermilion River, Sanders Co.	(1)	1 (3)	3 (15)	4 (19)
TOTAL	10 (39)	12 (53)	35 (157)	57 (249)

DISTRIBUTION

NORTH AMERICA

Breeding range. The Harlequin Duck breeds in two disjunct regions in North America (Fig. 2). The Pacific population breeds from western Alaska, northern Yukon, northern British Columbia, and southern Alberta south to Oregon, Idaho, Wyoming, and east of the Continental Divide in Montana. The Atlantic population breeds from Baffin Island (at least formerly) through central and eastern Quebec, eastern Labrador, and northern Newfoundland. Occurs in summer in Mackenzie Valley and near Great Slave Lake, Northwest Territories (American Ornithologists Union 1983, Harlequin Duck Working Group 1993, 1994).

In the Rocky Mountains of the United States, Harlequins currently breed in western Montana (Reichel and Genter 1995), northern and southeastern Idaho (Cassirer and Groves 1994), and northwestern Wyoming (Wallen 1993, McEneaney 1994) (Fig. 3). While much of Montana and Idaho has been surveyed (Fig. 1), some areas with potential habitat have yet to be completed; surveying in Wyoming is less complete. As of 1995, surveys have been conducted on approximately 5,640 km of streams (Montana - 2,963 km; Idaho - 1,886 km; Wyoming 792 km) (Cassirer *et al.* 1996).

In the literature and in unpublished reports, Harlequins within a geographical area often noted as "breeding on XX number of streams." This has been used differently by various authors to mean: 1) every named stream; 2) larger named streams; or 3) the major stream in an occupied drainage. Not all streams used by harlequin ducks during the breeding season are used for nesting or brood-rearing. Some streams where adult harlequins are observed may be used only during migration to and from breeding areas. In order to classify harlequin duck observations in a consistent manner, definitions have been proposed by Cassirer et al. (1996), the first two of which would be considered "Element Occurrences" (EOs) by Natural Heritage Programs/Conservation Data Centers throughout North America.

Harlequin duck breeding occurrence:

Drainages or portions of drainages used by harlequin ducks where breeding is known, i.e., a brood or nest has been observed within the last 15 years. Comprised of contiguous stream reaches (and portions of lakes, reservoirs, or bays) used during the courtship, nesting, and brood-rearing periods not separated by more than 10 km of unsuitable habitat or by 20 km of unoccupied, suitable habitat.

Probable harlequin duck breeding occurrence:

Drainages or portions of drainages used by harlequin ducks where breeding is highly suspected, i.e., there have been at least 3 independent pair or female observations within the last 15 years. Comprised of contiguous stream reaches (and portions of lakes, reservoirs, or bays) used during the courtship, nesting, and brood-rearing periods not separated by more than 10 km of unsuitable habitat or by 20 km of unoccupied, suitable habitat.

Breeding status unknown:

Drainages or portions of drainages with at least 1 harlequin duck observation but fewer than 3 independent pair or female observations during the breeding season within the last 15 years.

Breeding unlikely:

Observations of males during migration periods. The male migration periods are before 15 April and after 5 June in the Northern Columbia Basin and Rocky Mountain Front areas and before 1 May and after 20 June in the Intermountain region.

Observations of pairs outside the prenesting season. The prenesting season is from 15 April - 5 June in the Northern Columbia Basin and Rocky Mountain Front areas and from 1 May - 20 June in the Intermountain area.

Incidental observations in unsuitable habitat such as ponds or large, low gradient (<1%) rivers not adjacent to known breeding sites, or observations on streams which have been identified as lacking breeding activity (e.g. migratory staging areas or stopovers).

Applying these criteria to the U.S. Rocky Mountains, there are currently 48 known breeding occurrences (89 streams), 10 probable breeding occurrences (29 streams) and 81 streams where breeding status is unknown (Cassirer et al. 1996).

The breeding status on many streams with Harlequin Duck sightings has not been established in the Rocky Mountains of Montana, Idaho, or Wyoming. In Montana, there are currently 33 Harlequin Duck EOs, and 32 streams where Harlequin Ducks have been observed or reported but on which the breeding status is unknown; these streams have been surveyed 0-5 times each (Figure 3, Appendix B). In Idaho, there are currently 16 Harlequin Duck EOs, and 24 streams where Harlequin Ducks have been observed or reported but on which the breeding status is unknown; these streams have been surveyed 0-5 times each (Cassirer *et al.* 1996.). In Wyoming, there are currently 8 Harlequin Duck EOs, and 17 streams where Harlequin Ducks

have been observed or reported but on which the breeding status is unknown; these streams have been surveyed 0-5 times each (Cassirer *et al.* 1996.).

Using habitat characteristics, accessibility, amount of human use, and nearby Harlequin Duck occurrences, streams were identified that had the highest potential for Harlequin Duck occurrence but for which no ducks had been observed; these included 31 in Montana (Appendix B), 16 in Idaho, and 41 in Wyoming (Cassirer *et al.* 1996).

Winter range. Winters in the Aleutian and Pribilof islands south on the west coast of North America to Oregon, rarely to central California; southern Labrador, Newfoundland, Nova Scotia, south to Maryland (but mostly north of Cape Cod); accidental in Hawaii and the Great Lakes; much more abundant in the Aleutians than farther south in southwestern Canada and the U.S. Pacific Northwest (Fig. 2). Most Harlequins marked in Montana have been reported form wintering grounds off of British Columbia, with fewer reports from Washington and Oregon (see MOVEMENT: *Timing and routes of migration*).

OUTSIDE THE AMERICAS

In the Palearctic, the Harlequin Duck breeds in Iceland and Greenland in the Atlantic Ocean, and from the Lena River in Siberia east to Kamchatka and south to northern Mongolia, the Kurile Islands, and nothern Japan in the Pacific Ocean; winters in Eurasia south from the pack ice to the east coast of Korea and central Japan in the Pacific and on the Atlantic in the ice-free zones around Iceland and Greenland (Philips 1925, Salomonsen 1950, Dement'ev and Galdkov 1967, Portenko 1981, American Ornithologists Union 1983, Boertmann 1994) (Fig. 2).

HISTORICAL CHANGES

During the past 100 years, the range of the Harlequin Duck has undergone both large ands small scale contractions. Historically, Harlequins bred in Colorado, probably as a small isolated population, until at least 1883 (Parkes and Nelson 1976); currently, they do not breed in the state. In Oregon, Harlequins historically bred in the Wallowa and probably Blue Mountains of the northeastern part of the state (Gabrielson and Jewett 1940, Latta 1993). They are thought to have historically bred much more widely in the North Atlantic region (Merriam 1883, Peters and Burleigh 1951, Goudie 1989, 1993).

On a smaller scale, heavy white-water rafting is believed to have been the primary factor in the displacement and resulting extirpation of Harlequins on the Methow River in Washington (Brady pers. comm. *in* Clarkson 1994). In Yoho National Park, Alberta, Harlequins regularly bred in the vicinity of Lake Ohara until 1985; they have not since been seen (Hunt and Clarkson 1993). This area now has heavy recreational use, building facilities, and a hiking trail encircling the lake.

Within the Rocky Mountains of Montana, Idaho, and Wyoming, few historic records exist for either known current or extirpated Harlequin occurrences (Table 2). The scant existing evidence indicates that Harlequin Ducks were once more widespread. In addition to the historic Montana, Idaho, and Wyoming streams listed in Table 2, Harlequins have not been observed during recent surveys of Big Creek, Quartz Creek, or Trout Creek, Montana, indicating possible extirpation (Table 3).

Table 2. U.S. Rocky Mountain streams previously used by Harlequin Ducks where no use has been documented since 1988 (Cassirer et al. 1996, this report)

State	Historical consistent use documented	Historical occasional breeding documented	Historical occasional pair use documented
Idaho	Kelly Creek and N. Fork Clearwater River below Kelly Creek (3)[1]	Smith Creek (Kootenai River) (3)[1]	Orogrande Creek (N. Fork Clearwater River) (4)[1]
Montana	Kootenai Falls area of Kootenai River (13)[2]	Otatso Creek	Bighorn River Canyon Jocko River Sweet Water Creek
Wyoming			Shell Creek Canyon

[1]Number in parentheses represents the number of surveys between 1989 - 1994
[2]Number in parentheses represents the number of surveys between 1989 - 1995

Table 3. Streams in Montana where Harlequins have not been observed during recent surveys.

Stream	Last year seen	Years surveyed since last seen
Big Creek (Kootenai R.)	1990	1991, 93, 94, 95
Quartz Creek (Kootenai R.)	1988	1989, 90, 95
Trout Creek (Superior)	1990	1991, 92, 93, 95

Figure 1. Streams surveyed for Harlequin Ducks in Montana, Idaho, and Wyoming during the period 1985 - 1995.

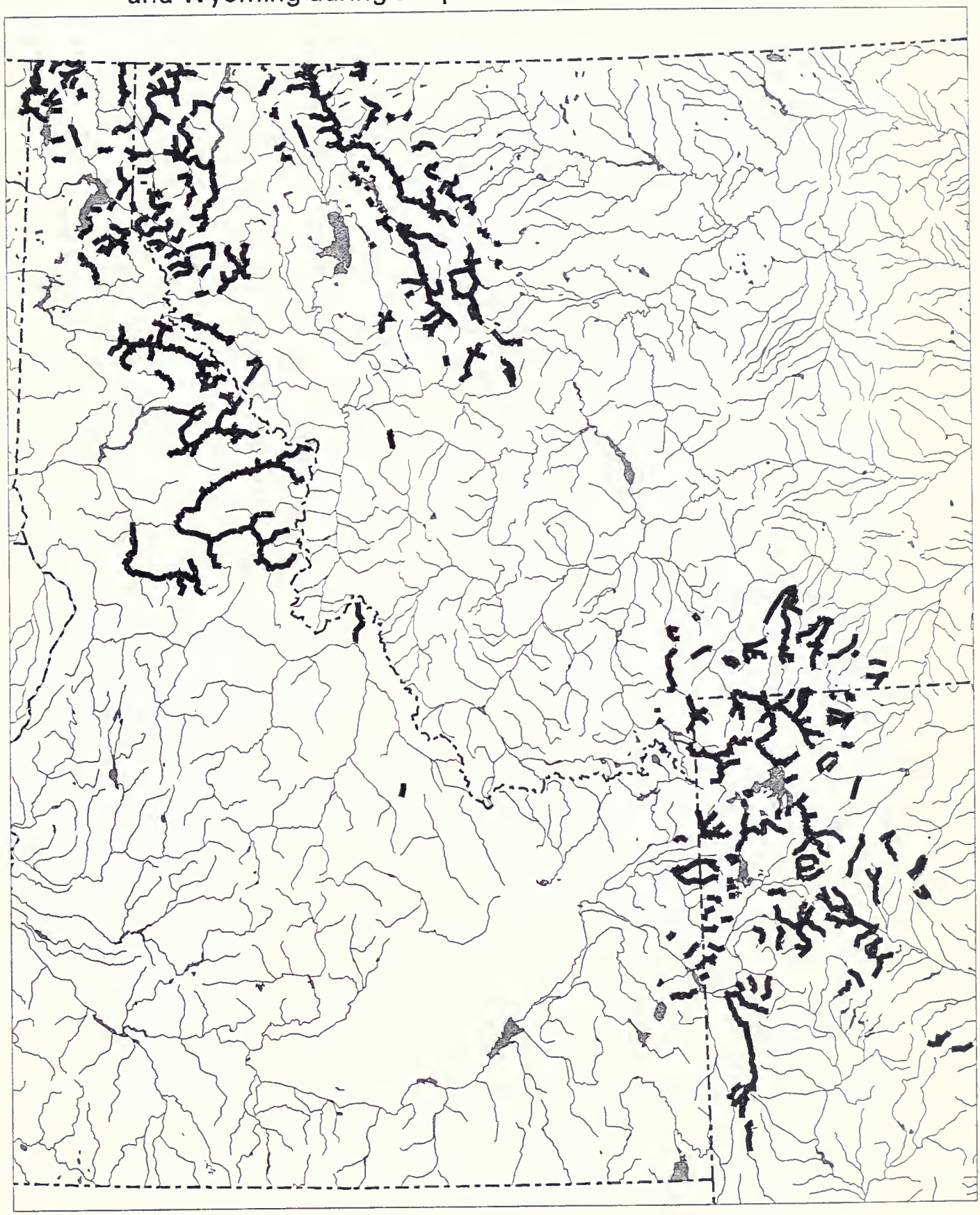

Figure 3. Breeding and probable breeding streams in Montana, Idaho and Wyoming

breeding
probable breeding
breeding status unknown
national forests/national parks

0 50
Scale in miles

November 27, 1996
Montana Natural Heritage Program

MOVEMENT

ON THE BREEDING GROUNDS

In Montana and Idaho, several relatively long-distance movements have been documented both within and between years (Table 4). Two males and several breeding females were observed using different nearby drainages during different years. These observations indicate that movements within a drainage, both within and between years, of up to 30 km may regularly, but rarely, occur. Movements occurred even over large reservoirs (Noxon Reservoir) and lakes (Lake McDonald). The 1995 movement by a female and her entire fledged brood to the Vermilion River (Table 4) was likely the result of disturbance due to marking; however, the movement took place at least 4 hours following the release of the birds. The female in Glacier Park (Table 4) has been seen at several locations on different streams over the 4 years since her banding (Ashley 1995); the locations in Table 4 are maximum total known distances moved during the 4 year period.

There is little published literature regarding movement within the breeding grounds. Kuchel (1977) found that pairs used lower McDonald Creek prior to establishing home ranges higher up along the stream. Once established, pairs rarely moved more than 1-2 km, although movements of up to 8 km were recorded. Kuchel (1977) found unpaired males moved considerably more, with movements of up to 10 km found. In a reanalysis of Kuchel's (1977) data, Cassirer and Groves (1992) found that linear home ranges averaged 7.7 km ($SD = 2.34$) on McDonald Creek, similar to the 7 km reaches used in Idaho.

On the Bow River in Banff National Park, 5 pairs of birds were marked at what is probably a staging area or local migratory corridor (Smith 1996). Two pairs remained in a 2 km section of river where they were banded, and another remained in a 2 km stretch about 12 km downstream; one pair remained within about 6 km until the female moved about 8 km up a drainage, perhaps to breed; the final pair moved about 15 km downstream within 22 days (Smith 1996).

For 35 Harlequins marked in Iceland, Bengtson (1972) found no movement overland between breeding streams and movement of only a few km within drainages. Not only did the birds return to the same drainage, but in 22 out of 33 cases, the birds were observed within 100 m of their locations during the previous year (Bengtson 1972).

Table 4. Significant movements of Harlequins within and between years on the breeding grounds (Cassirer and Groves 1994, Reichel and Genter 1994; Ashley 1995, Cassirer pers. comm.; this report).

Sex and age	1st Date	Location	2nd Date	Location	Km moved
Adult Male	1990	Gold Creek, ID	1991	Granite Creek, ID	14
Adult Male 755-76075	5/26/93	Marten Creek, Devils Gap	4/27/95	Vermilion River, 0.1 mi above Miners Gulch	31
Adult Female	5/85	Hughes Fork, ID	7/17/91	Upper Priest River, ID	??
Adult Female 755-76007	8/4/92	Marten Creek, mouth of (w/ brood)	7/30/93	Swamp Creek, T25N R31W Section 9 (w/ brood)	16
Adult Female 755-76025	8/10/92	McDonald Creek above McDonald Lake (w/ brood)	6/29/95	Middle Fork Flathead River (w/ brood)	18
Adult Female 755-76013	7/28/95	Marten Creek, near mouth of (with 6 young 925-09336, 37, 38, 39, 40, 41	7/29/95	Vermilion River (with 6 young 925-09336, 37, 38, 39, 40, 41	26

MIGRATION

Nature of migration in the species. All inland populations of the species migrate to coastal waters. A marked female seen on Granite Creek, Idaho on 17 July 1991 was relocated 13 days later off of Battleship Island in the San Juan Islands, Washington (Cassirer and Groves 1992). In Iceland, birds are thought to swim up the rivers from the coastal wintering grounds to the freshwater breeding sites (Gudmundsson 1961 *in* Bengtson 1966).

Several lines of reasoning indicate that pairs migrate to the breeding grounds together: 1) two pairs marked on the breeding grounds in McDonald Creek, Montana, have been seen, apparently paired, in the spring on Hornby Island, B.C., prior to migration (Ashley pers. comm.); 2) one bird of a pair is not seen prior to the arrival of the other - they are seen for the first time together; and 3) there are no records of lone males observed later paired during the same year.

Sibling juveniles may migrate together to the coast, as indicated by the presence of 3 siblings at Hornby Island, B.C., which were marked together 7 months earlier on Swamp Creek, Montana. Whether females and their broods migrate together in some instances is unknown. However, it is known that females occasionally leave prior to their young fledging. In Montana, out of 102 brood observations during 1988-95, 12 broods (12%) were found without the hen prior to migration (this report, Ashley pers. comm.). Of the 12 abandoned broods, 1 was first seen alone when Class I, 2 were Class II, 2 were Class III, and 7 broods were first observed without the adult female following fledging. In one additional case, a brood of 7 was marked with the female on 11Aug 1992; on 2 September the female was seen with 5 of her fledged juveniles, while one of the brood was observed 2.5 km away.

Timing and routes of migration. Harlequins, typically unpaired males, begin to arrive in Montana in mid-April (Kuchel 1977, Ashley 1994); the earliest record for Glacier National Park is 4 April 1970, on the Middle Fork Flathead River (Kuchel 1977:32). Pairs in Montana begin to

arrive in late April, and most are present by early May (Kuchel 1977, Ashley 1994, Reichel and Genter unpubl. data). Two-year-old females may arrive later than older females (Ashley 1994, Kuchel 1977:32); this age group may be the unpaired females that Wallen (1987) reported as arriving about 4 weeks later than pairs and then not breeding. Males begin leaving Montana by late-May, and are typically gone by late June (Kuchel 1977, Reichel and Genter 1993, Ashley 1994). Females begin leaving by early July if breeding is unsuccessful, and otherwise by mid-late July. Juvenile birds leave last, beginning in late July, and both adult females and juveniles are gone by the beginning of September (Ashley 1994, Reichel and Genter unpubl. data).

In Washington, birds arrive on breeding streams in late March or early April (Schirato 1993). In Oregon, birds arrive on the breeding streams in late April, although some have been reported as early as late February (Latta 1993).

Of 249 Harlequins banded in Montana from 1991-1995, a minimum of 24 have been reported from Oregon (2), Washington (1), and southern British Columbia (21), including Vancouver Island and Hornby Island. Sexes and ages at banding show the following numbers and percentages observed: adult females (6, 11%), adult males (2, 5%), juvenile females (9, 7%), and juvenile males (7, 5%). Two females radio-marked in Idaho were located in the San Juan and Gulf Islands of Washington and British Columbia, while one banded bird was reported from northwestern Washington (Cassirer and Groves 1994). The only known wintering bird marked in Wyoming was observed off of San Juan Island in Washington in August 1989; he returned to Grand Teton National Park as an unpaired male in 1990 (Cassirer and Groves 1991, Wallen 1993).

Some evidence of staging areas on the breeding grounds exists. Some marked harlequins observed in early spring on McDonald Creek, Montana, disappear almost immediately (Kuchel 1977, Ashley pers. comm.); these may be going to different drainages in the vicinity. At Kootenai Falls, Montana, in the early 1980s, only 1 pair bred in the immediate vicinity, while up to 6 other adults appeared to loaf there prior to and following the breeding season (Thompson 1985, Genter unpubl. data).

There are few records of birds stopping between their breeding areas and wintering areas. A single marked bird has been observed en route from wintering to breeding grounds. She was originally marked in Wyoming and observed on the way back to the breeding stream on Crooked Creek, South Fork Clearwater drainage, in central Idaho and seen about a week later in Grand Teton National Park (Cassirer and Groves 1991, Wallen 1993).

Migratory behavior. It is believed that nearly all one-year-old birds, and some (perhaps most) two-year-old birds remain in coastal water, not moving to breeding streams until they are 2-4 years of age. The proportion of each age class which stays on the coast has yet to be determined, but indications are that perhaps ½ of 2-year-old females and ¼ of 3-year-old females do not return to the breeding grounds (see DEMOGRAPHY AND POPULATIONS: MEASURES OF BREEDING ACTIVITY - *Age at first breeding; intervals between breeding*). Wallen (1987) reported that a 1-year-old female (n=11) returned to Upper Moose Creek, her natal stream in Grand Teton National Park in 1986. This is the only report of a 1-year-old female on the breeding grounds. No one- or two-year-old males, out of 176 male observations, have been seen in Montana during 1992-95 surveys (this report, Ashley pers. comm.).

DEMOGRAPHY AND POPULATIONS

MEASURES OF BREEDING ACTIVITY

Age at first breeding; intervals between breeding. Only a single known-aged male has been seen with a mate; it was marked as a juvenile in 1992 on Mineral Creek, Montana, and observed by J. Ashley paired with a female (white NH) at Hornby Island, BC, in March 1996. Adult male breeding plumage is attained at three years of age (Phillips 1925). No one- or two-year-old males, out of 176 independent male observations, have been observed in Montana during 1992-95 surveys (this report, Ashley pers. comm.). Very few, if any, 1 or 2-year-old males have been reported on the breeding grounds in North America. Yearling males make up 1-2% of the population on the breeding grounds in Iceland (Bengtson 1972, Gardarsson 1979).

The youngest female known to have bred is a 2-year-old which raised a brood of 3 in 1994 on Trail Creek, Montana; nine additional non-breeding (or not successfully breeding) 2-year-olds have been observed on natal streams and 16 marked 2-year-olds are known to have been alive. Additionally, only a single 3-year-old has bred successfully (on Marten Creek in 1995); 7 additional non-breeding 3-year-olds have been observed on natal streams, and 11 marked 3-year-olds are known to have been alive. Ages of females when first seen on the breeding grounds have included 2-year-olds (10) and 3-year-olds (4); females seen on the wintering grounds, that had not been seen on the breeding grounds, included 1-year-olds (2) and 3-year-olds (3). Since we began marking juveniles in 1992, the oldest known-age birds in 1995 were 3-year-olds. In Iceland, Bengtson (1966) believed that 2-year-old females Harlequins did not regularly go to the breeding grounds; this was opinion, and not based on known-age birds.

Some females on breeding streams apparently, however, do not lay eggs (Bengtson and Ulfstrand 1971, Dzinbal 1982, Wallen 1987, Cassirer and Groves 1991). Bengtson and Ulfstrand (1971) classified 15-30% (n=48) of adult (by bursae inspection) females as non-breeders, and found that 87% of all clutches were successful; therefore, approximately 90% of non-breeding females did not even attempt to breed in Iceland. Additionally, examination of ovaries of 6 non-breeding females showed that none had lain eggs (Bengtson and Ulfstrand 1971). Many of these non-breeding "adults" may have been young (2-3 year-old) birds, since cloacal examination gives adult status to 2-year-olds. Dzinbal (1982) estimated that 53-95% of females not producing broods did not attempt to breed; those results may have been due to use of patagial markers negatively affecting breeding behavior (Bustnes and Erikstad 1990). Wallen (1987) reported that some females left the breeding stream at the same time as their mates; unpaired females arrived about 4 weeks later than pairs, did not breed, and left after 3-5 weeks.

Clutch size. Twelve clutches from the Pacific Northwest averaged 6.25 eggs (range 3-7) and are listed below. In Montana, a clutch of 5 was reported (Diamond and Finnegan 1993), four clutches of 6, 6, 7, and 7 were reported in British Columbia (Campbell *et al.* 1990), and 2 clutches of 7 were reported in Washington (Jewett *et al.* 1953). Cassirer *et al.* (1993) reported 3 nests with 3, 5, and 7 eggs in Idaho. Thompson *et al.* (1993) reported 2 nests, each with 7 eggs, in Oregon, while Gabrielson and Jewett (1940) reported a clutch of 6 eggs on 30 May 1931 on the Salmon River near Zigzag. In Iceland, 77 complete clutches averaged 5.7 eggs with a range of 3-9 (Bengtson 1972). There was a seasonal decline in clutch size (Bengtson 1972). The mean number of eggs to hatch from successful nests was 5.3 (Bengtson 1972). A single known Greenland clutch was 8 (Salomonsen 1950).

Annual and lifetime reproductive success. Reproductive success was poor in Montana in 1995, with one of the lowest numbers of broods and young per female recorded since 1989 (Table 5, 6). In Montana during 1974-1975 and 1989-1995, annual numbers of ducklings fledged per adult female averaged 1.39 and ranged from 0.13 - 3.15 (n=305 adult females) (Table 6). Brood size (IIb to fledging) averaged 3.59 and ranged from 2.00 - 5.86 (n=118 broods) (Table 6).

Broods ranged from 1-6 in Oregon and averaged 2.7 (n=26) (Thompson *et al.* 1993, 1994). These sightings, however, were spread throughout the breeding season and therefore should not be considered the same as numbers fledged.

In Idaho, number of ducklings fledged per adult female ranged from 0.7 - 1.3 and averaged 1.2 (n=14); number of females producing broods was 29% in 1990 (Cassirer and Groves 1991, 1994). Average brood size was 3.4 (range 1-7) in Idaho (n=24) (Cassirer and Groves 1991).

In British Columbia, 41 broods of all ages ranged in size from 1 - 10 (1Y-3, 2Y-3, 3Y-5, 4Y-11, 5Y-14, 6Y-2, 7Y-1, 8Y-1, 10Y-1); the brood with 10 young was apparently from a single female (Campbell *et al.* 1990).

In Alaska, numbers of young per breeding female and per adult female were respectively 1.5 and 0.8 in 1979, and 0.6 and 0.3 in 1980; patagial tags on adults appeared to have caused poor reproductive success (Dzinbal 1982). Non-breeding frequency of females was 47% in 1979 and 50% in 1980 (Dzinbal 1982).

In Iceland, 1.73 (85:49) and 2.43 (120:49) young per adult female were successfully raised during 1975 and 1976, respectively (Gardarsson 1979). In an increasing population in Iceland, productivity ranged from 0.1 to 3.3 ($x = 1.1$) ducklings fledged per hen per year over 15 years (Gardarsson and Einarsson 1991). These results were similar to those of Bengtson (1972), who reported 0.0 to 3.8 young per adult female on 4 rivers during 4 years.

Proportion of total females that rear at least one brood to nest-leaving. Harlequin Ducks raise only a single brood each year. The proportion of females successfully raising a brood in a single year varies widely between years. In Montana during 1995, only 23% of 48 females successfully raised a brood (Table 5); stream surveys between 1974 and 1995 found that 305 females raised 118 broods for an average of 38.7% (range 7-55%) (Table 6). From throughout their range, the percentage of females which successfully raise a brood varies from 7-56% (Bengtson and Ulfstrand 1971, Kuchel 1977, Wallen 1987, Cassirer and Groves 1991, this report).

Table 5. Harlequin Duck reproduction in 1995 for streams with both pair and brood surveys.

Stream	#Adult Females	#Broods	#Young
Flathead Drainage			
McDonald Creek	22	1	1
Spotted Bear River	2	1	5
Sullivan Creek	2	0	0
Trail Creek	6	0	0
Drainage Total	32	2	6
0.06 Broods per adult female			
0.19 Young per adult female			
3.00 Young per brood			
Lower Clark Fork Drainage			
Marten Creek	5	2	11
Rock Creek	#1	1	5
Swamp Creek	3	2	10
Vermilion River	2	2	5
Drainage Total	11	7	31
0.64 Broods per adult female			
2.82 Young per adult female			
4.43 Young per brood			
Other			
Callahan Creek	1	0	0
Grave Creek	4	2	*5
Drainage Total	5	2	5
0.40 Broods per adult female			
1.00 Young per adult female			
2.50 Young per brood			
GRAND TOTAL	48	11	42
0.23 Broods per adult female			
0.87 Young per adult female			
3.82 Young per brood			

= Probably an underestimate

* = Two unknown age ducks also present; may have been juveniles.

Table 6. Harlequin Duck reproductive parameters for 1974-75 (Kuchel 1977) and 1989-1995.

Year	# adult females	# broods	# young	broods per ad. female	young per ad. female	young per brood
1974	11	3	12	27%	1.09	4.00
1975	15	1	2	7%	0.13	2.00
1989	13	7	41	54%	3.15	5.86
1990*	31	17	65	55%	2.10	3.82
1991*	37	9	31	24%	0.84	3.44
1992*#	71	39	132	55%	1.37	3.38
1993#	49	21	59	43%	1.20	2.81
1994#	30	10	40	33%	1.33	4.00
1995#	48	11	42	23%	0.87	3.82
Total	305	118	424			
Mean				38.7%	1.39	3.59

* includes data from the Rocky Mountain Front (Diamond and Finnegan 1992, 1993)
# Includes data from Ashley (1994a, 1994b, 1995, pers. comm.)

Sex ratio. During the spring pair season, a sex ratio of 1.51:1 has been observed in Montana (m:f, n =600) (Table 7). Table 7 is based on independent male observations during the period 27 April - 30 May; when more than one survey was done during a single season on a single stream, the survey with the maximum number of females was included in Table 7. Cassirer (1995) found a spring adult sex ratio of 1.31:1 (m:f, n = 81) in 1995 on Idaho streams. In Banff National Park, Alberta, sex ratios varied from 1.37:1 in May to 1.81 in June (Smith 1996). In Iceland, sex ratios on the breeding grounds varied from 1.17 - 2.33:1 during 5 summers in late May - early June (Bengtson 1966, Bengtson 1972, Gardarsson 1979).

In coastal British Columbia, the apparent sex ratio is 1.5:1 (544 birds) in winter, declining to 1.4:1 (297 birds) in March-April (Campbell *et al.* 1990); this grows to 4.3:1 in May, and by July, when adult females are still on the breeding streams, it reaches 18.2:1 (1633 birds).

Table 7. Sex Ratios of Harlequin Ducks on Breeding Streams during pair season in Montana.

Location	# Males	# Females	Year (s)	Citation
Montana (NW)	10	4	1990	Fairman and Miller 1990
Montana (NW)	1	1	1991	Lee and Genter 1991
Montana (NW)	1	1	1989	Miller 1989
Montana (RMF)	50	26	1991	Diamond and Finnegan 1992
Montana (RMF)	44	30	1992	Diamond and Finnegan 1993
Montana (SW)	6	3	1990	Markum and Genter 1990
Montana (NW)	14	12	1990	Carlson 1990
Montana (NW)	11	6	1989	Fairman, Genter and Jones 1989
Montana	37	23	1995	this survey
Montana	27	17	1994	Reichel and Genter, unpubl. data
Montana	19	12	1993	Reichel and Genter, unpubl. data
Montana	10	8	1992	Reichel and Genter, unpubl. data
Glacier NP	19	18	1993	Ashley 1994a
Glacier NP	29	27	1994	Ashley 1994b
Glacier NP	35	25	1995	Ashley 1995
Glacier NP	22	11	1974	Kuchel 1977
Glacier NP	26	15	1975	Kuchel 1977
TOTAL	361	239		

LIFE SPAN AND SURVIVORSHIP

In Montana, 249 Harlequins (39 adult males, 53 adult females, 157 juveniles) have been banded from 1991 through 1995. Adult males returned to the breeding streams when they had lived during the previous year on 53% (n=51) of occasions, while females returned at a rate of 57% (n=81). The higher female rate may be due to the fact that a male may mate with a new female, which could lead him to a new stream, so that he would not be seen on the previous year's stream. For comparison with other studies, 50% of males (n=30) and 55% of females (n=30) returned at least 1 year following marking. Of 40 females marked as adults through 1993, 6 had a gap of one breeding season between resightings on the breeding grounds; none marked through 1992 (n=23) had a two season gap. In 5 cases (n=21), males marked as adults had a gap of one breeding season between resightings, and in 1 case (n=9), a two season gap. Of 58 juveniles marked in 1992, at least 16 females and 4 males were alive in 1994, and 11 females and

3 males were alive in 1995; of 42 juveniles marked in 1993, at least 1 female and 1 male were alive in 1995. All males known to be alive were seen on the wintering grounds only.

In Glacier National Park, all mortality of ducklings (through fledging) took place in the first three weeks of life (Kuchel 1977). This is similar to the findings of Bengtson (1966, 1972), who reported that of 7 broods totaling 37 ducklings, 24 survived one week, and 19 survived two weeks; little mortality was seen after two weeks. Bengtson (1972) reported that survival of ducklings ranged from 40-76% on 3 streams over 5 years. An extreme example showing little mortality after 1-2 weeks is a brood of 5 Class Ib young (8-15 days-old), which was first seen on Marten Creek, Montana, on 10 July 1995, without an adult female present. All survived and were nearly flying on 28 July 1995.

In Idaho, 63% of adults (n=30) returned at least 1 year; male and female rates were not significantly different (Cassirer and Groves 1994); one duck marked as an adult in 1988 returned through 1993 (minimum 7 years old). No ducklings marked from 1988-1991 were re-observed (n=27). In Wyoming, 40% of marked adults returned to breeding streams (Wallen 1993). At least 5 females of 103 ducklings banded in 1987-1990 have returned and nested successfully (Wallen 1991). The oldest known Wyoming bird was marked as a duckling in 1985 and recaptured in 1991 (Wallen 1993). In Alaska, 30% (8) of adult females and 30% (3) of adult males marked were relocated the following year (Dzinbal 1982:62).

In Iceland, 64% (20) of adult females and 48% (13) of adult males, marked with nasal discs, were relocated the following year (Bengtson 1972). Hatching success in Iceland averaged 87%, and ranged from 84% to 91% in four years (Bengtson 1972).

CAUSES OF MORTALITY

Causes of death. Reproduction in Montana in 1995 was one of the poorest on record (Table 5, 6). Table 5 shows the North Fork Flathead drainage reproduction to be almost non-existent, while reproduction on Lower Clark Fork streams was near average. An extremely heavy spring storm in the North Fork caused streams to exceed 100-year flood levels (M. White pers. comm. *in* Ashley 1995); this heavy storm and flood did not hit the Lower Clark Fork area. Throughout Montana, high water during early summer runoff has been associated with low productivity by a number of studies (Kuchel 1977; Diamond and Finnegan 1992, 1993; Reichel and Genter 1993, 1995). Possible explanations for the negative correlation of survival with run-off include females not nesting due to high water and/or poor feeding; destruction of nests within the floodplain; or loss of juveniles due to drowning, separation from the female, inability to feed effectively, or hypothermia.

In Idaho, productivity was negatively correlated to June stream flow ($r = -0.93$, $p = 0.006$) (Cassirer and Groves 1995). Wallen (1987) reported that neither of two broods seen prior to a severe July rainstorm, which raised a creek level 0.6 m within 2 hours, was ever seen again; however, he generally felt that drought in the Grand Tetons was more limiting to reproductive success than was flooding. Dzinbal (1982) reported that higher spring run-off was associated with lower reproduction in a two-year study in Alaska.

Bengtson (1972) found that very low duckling survival coincided with adverse weather and with very low abundance of blackflies, the preferred food in the study area.

In coastal waters, Harlequins are occasionally caught by the bill and drowned by large mussels and clams (Turner 1886 *in* Philips 1925).

Exposure and predation. Predation on eggs by river otters (*Lutra canadensis*) and by black bears (*Ursus americanus*) has been reported in Washington (Jeff Foster unpubl. data, *in* Schirato 1993).

Following mink (*Mustela vison*) introduction in Iceland, Harlequin populations substantially declined in several areas and changed nesting sites in others (Bengtson 1966). Predators including the Raven (*Covus corax*) (5), mink (2), Parasitic Jaeger (*Stercorarius parasiticus*) (1), and arctic fox (*Alopex lagopus*) (1) took 9 nests in Iceland (n=89) (Bengtson 1972). Additionally, 2 nests were deserted, and 1 failed to hatch (Bengtson 1972). Arctic Skuas were seen taking 2 chicks in Iceland (Bengtson 1972).

RANGE

Dispersal from natal stream. In Montana, juveniles apparently leave the natal stream soon after fledging. At least 13 broods fledged prior to leaving the breeding stream (n=69) and many more may have waited that long, but follow-up surveys were not done. In McDonald Creek, Montana, Kuchel (1977) reported that at least one brood had left prior to fledging, apparently swimming across McDonald Lake and drifting downstream. In Alaska, one brood was reported to use Stellar Lake when very young, moving down to Stellar Creek when older, and finally using Stellar Bay and the lower tidal portion of Stellar Creek when Class IIc-III (Dzinbal 1982).

Fidelity to natal stream. Of 100 ducklings marked in 1992-93 in Montana, 14 females are known to have survived at least 2 years. Of the 14 surviving females, 5 were reported only from their natal stream, 1 only from the coast, and 8 from both the coast and the natal breeding stream. Seven males marked as juveniles were seen only on the coast; none have been reported from their natal stream (Ashley 1995, this report). In Glacier National Park, 2 of 5 ducks banded as juveniles in 1974 returned to the natal stream in 1976; both were females (Kuchel 1977).

No ducklings marked from 1988-1991 in Idaho have been re-observed (n=27) (Cassirer pers. comm.).

Adult fidelity to breeding stream. In Montana, all 3 males marked as adults and later seen on the wintering grounds returned to the breeding grounds the following year. A single female (n=47), marked on McDonald Creek Montana in 1992 and not seen there since, was observed on Hornby Island, British Columbia, in March of 1995 and 1996. Given the intensive survey effort in Montana during that period (Figure 1, Appendix G), it is likely that she had substantially shifted her breeding location since being originally marked. This case constitutes the only evidence that breeding streams may be abandoned.

POPULATION STATUS

Estimates or counts of density. Densities of Harlequins on breeding streams range from 0.05 pairs/km on a stream in Montana (Diamond and Finnegan 1993) to 8.5 pairs/km on part of the Laxa River in Iceland (Bengtson and Ulfstrand 1971). In Montana, pair density on a 16 km section of McDonald Creek was 0.67/km in 1974 and 0.91/km in 1975 (Kuchel 1977). On the Rocky Mountain Front, densities ranged from 0.05 pairs/km to 0.21 pairs/km (Diamond and Finnegan 1993).

In Idaho, pair densities averaged 0.19/km (range 0.08-0.57) of occupied streams surveyed (Cassirer 1995). From 1990 through 1992, densities there averaged 0.06-0.53 pairs/km ($\bar{x}$= 0.22) (Cassirer 1993). In Oregon, densities of adults per km surveyed ranged from 0.07 to 1.21;

densities per km surveyed including juveniles ranged from 0.07 to 2.37 (Thompson *et al.* 1993, 1994).

On the Bow River in Banff National Park, densities observed were the highest known from streams in North America, ranging from 2.4 ducks/km on a 15 km reach to 6.2 on a 16 km reach (Smith 1996).

On Kodiak Island, Alaska, density of breeding Harlequin pairs ranged from 0.63 pairs/km along the Ayakulik River to 1.98-7.24 birds/km in 3 coastal bays (Zwiefelhofer 1994). Dzinbal (1982) reported 1.3-1.8 pairs/km on two small coastal streams in Alaska.

On the Laxa River in Iceland, Harlequins are apparently present at densities higher than other known stream populations (Bengtson 1972). Twenty populations in Iceland ranged from 0.2 to 8.5 pairs/km, with an average of 0.9 pairs/km (Bengtson and Ulfstrand 1971, Bengtson 1972).

In eastern Siberia, Kistschinsky (1968 *in* Bengtson 1972) found 1.1 pairs/km and 0.8 - 1.2 broods/km.

Numbers. Numbers estimated by most recent publications and reports are listed in Table 8. Cassirer et al. (1996) reported that the maximum percentage of pairs observed during surveys done under optimal conditions was 69%. This is similar to the 75% (range 67-81%) reported by Ashley (pers. comm.) on McDonald Creek during 1993-1996. Estimated pair numbers for Montana (Table 8) were calculated using 72%. However, that percentage was not used to adjust minimum numbers on streams when a high proportion of ducks were individually marked and multiple surveys took place in several years; in those cases 90% was used. A minimum of 151 pairs of ducks nest in Montana, which represents an estimated 198 total pairs (Table 8, Appendix F).

The largest single reported Harlequin Duck occurrence (see ***Breeding Range***) is from the Bow River drainage in Banff National Park, Alberta, where, using a mark/resight model, 215 individuals were calculated to occur during 1995 (Smith 1996).

Table 8. Estimated numbers of Harlequin Ducks.

Location	Estimated Breeding Population	Minimum # Pairs	Estimated # Pairs @	Citation
Atlantic Ocean	10,000			
Greenland	5,000			Montevecchi et al. 1995
Iceland	3-5,000			Montevecchi et al. 1995
North America	<1,000			Goudie 1991
Pacific Ocean (Asia)	50-100,000			Goudie et al. 1994
Russia	50-100,000			Goudie et al. 1994
Japan	<100			Brazil 1991
Pacific Ocean (North America)	165,000			Goudie et al. 1994
Lower 48 U.S. States	2,391	563	797	
Washington		274	399	Schirato 1994
Montana		151	198	this report
Oregon		50	72	Thompson et al. 1993
Idaho		48	70	Cassirer et al. 1996
Wyoming		40	58	Cassirer et al. 1996

@ After Cassirer et al. (1996) except for Montana (see text)

Trends. Little long or short term data is available. In Montana, the long-term trend appears to be downward. Occurrences with larger populations (>5 pairs) appear to be stable over the last 4-8 years, while some small occurrences appear to be declining or have recently gone extinct (see DISTRIBUTION - HISTORICAL CHANGES); however, this data has not been statistically analyzed. In general, the recent North American Pacific populations trend is not clear-cut but generally appears to be declining. Christmas bird counts in British Columbia show declines at 5 locations and increases at 3; the increases, however, may be due to increasing numbers of observers in urban areas (Harlequin Duck Working Group 1993). In Alberta, breeding Harlequins are significantly declining on the Maligne River in Jasper National Park (Harlequin Duck Working Group 1993). Seven streams in Northern Idaho appear to be stable, though 1 stream shows a decrease and one shows an increase; all populations are relatively small (Cassirer 1995). In Wyoming, breeding populations appear to be stable in Grand Teton National Park (Harlequin Duck Working Group 1993). In Alaska, a major population in Prince William Sound has been decimated by the *Exxon Valdez* oil spill (Goudie et al. 1994). The Asian Pacific population appears to be declining rapidly in eastern Siberia (Goudie et al. 1994).

The Atlantic population has undergone and is continuing to undergo significant declines (Harlequin Duck Working Group 1993). Trends in the Greenland and Iceland populations are unknown.

POPULATION REGULATION

A simple model using "guesstimates" for values of survival and fecundity was developed by Goudie and Breault (1994). They estimated that at 85% adult survival, the population would grow at a rate of 6%/year. Simulations indicate that the model was most affected by adult survival; an increase of 3% in mortality may not be sustainable over the long term (Goudie and Breault 1994).

CONSERVATION AND MANAGEMENT

EFFECTS OF HUMAN ACTIVITY ON HARLEQUIN DUCK POPULATIONS, REPRODUCTION, AND BEHAVIOR

Disturbance on the breeding grounds. *On and near shore.* Kuchel (1977) found that broods less than 4 weeks old avoided areas with human access and selected areas that were distant from access or inaccessible ($p<0.05$) on McDonald Creek in Glacier National Park. This was not true of adults during May and early June when fewer park visitors were present. More recently, Ashley (1994) found that Harlequins used inaccessible areas in greater proportions than the availability of those areas, though not significantly so; this data is conservative in that surveys took place in the early morning prior to the vast majority of visitor use. Most Harlequins left accessible stream reaches when visitor use reached greater than minimal levels. Ashley (1994) found that males were displaced by human activity to a greater extent than were females, which he speculated could be due to any or all of three reasons. First, females were likely born in Glacier National Park with its many visitors, and were therefore more habituated to humans than were males, which were likely born at other locations. Second, females spend more time each year on McDonald Creek during higher visitation periods than do males, and may thus be more habituated to human contact. Third, females are more cryptically colored and therefore less likely to attract casual visitor attention.

On the Rocky Mountain Front in Montana, only 15% of sightings were in areas that were inaccessible (>50 m from established areas of human activity, not accessible by trail) (Diamond and Finnegan 1993). Of the accessible areas, 51% were >50 m from a trail, 21% were 10-50 m from a trail and 13% were <10 m from a trail; it should be noted that >90% of this area is roadless. Visitor use is highest along the South Fork Sun River: 500 people/month use the trail in July and August (Diamond and Finnegan 1993).

In Grand Teton National Park, Wyoming, 95% of Harlequin observations were in backcountry areas, accessible only by trail (Wallen 1987). Within the backcountry however, Harlequins used areas with moderate (5-9 people/day) to heavy (>10 people/day) human use more than they used areas with less human use; Wallen (1987) suggested that these observations may have been the result of the presence of many high gradient, inaccessible stream reaches which lacked the habitat features preferred by Harlequins.

In Yellowstone National Park, a three-year study was done to assess visitor impacts to Harlequin use at LeHardy Rapids, where it appeared that duck use had decreased due to high visitor use (McEneaney 1994). The area was closed to visitors from 1 May - 7 June 1991-1993, and Harlequin Duck use increased; however, a historical nest site in the immediate vicinity was

not reoccupied (McEneaney 1994). Beginning in 1995, visitors were to be confined to a boardwalk.

In Idaho, Harlequin Ducks were typically found at sites more than 50 m from road or trail access (adults = 75%, broods = 80%) (Cassirer and Groves 1994). Pair densities there were lowest on streams most accessible to human activity (Cassirer and Groves 1991). In Oregon, duck sightings were much closer to sites with established human activity, with 48% being within 10 m of activity sites (roads 48%, fishing 29%, hiking 19%) (Thompson *et al.* 1993).

In Washington, a cavity nest with the opening 2.4 m high was located 1.3 m from a trail (in 1991) and within a back country corral (1992); the depth of the nest cavity (61 cm) prevented the hen from seeing outside and hid her from view (Cassirer *et al.* 1993). Two nest cavities in Idaho however, were located in areas seldom used by humans, about 150 m from logging roads (Cassirer *et al.* 1993).

In Jasper National Park, visitor use by hikers, nature tours, fishermen, tourists, and boaters (see below) on the Maligne River drainage has increased substantially in the past decade; during that period, Harlequin Duck numbers have decreased substantially (Clarkson 1992, Hunt 1993). It was felt that disturbance was likely the cause of the decline, and recommendations were therefore made to revise methods of controlling rafting including: closing particular river reaches to boating and to other human activity; and not issuing new business licenses/special activity permits which would increase the current level of human activity in the area (Clarkson 1992).

Within the stream. Cassirer and Groves (1991) reported that 5 of 11 streams where Harlequin breeding had been reported or confirmed during 1988-1990 were closed to fishing or did not open to fishing until 1 July.

Wallen (1987) reported that fishing seemed more disruptive to Harlequins than hiking. Harlequins were found to avoid humans on the bank or in the stream bed; birds would typically swim or dive downstream past people, keeping partially submerged when past and watching behind themselves while moving out of the area. Two hens with broods abandoned a section of one creek when fishing pressure increased in August; they moved to a nearby creek which drained into the same lake, where fishing was not observed (Wallen 1987).

In boats. Prior to significant raft and canoe use on rivers in Jasper and Banff, Holroyd (1979) warned of the potential negative effects of intensive river use on Harlequin Ducks. Since that time, commercial whitewater rafting in Jasper National Park has frequently exposed pre-nesting and perhaps nesting ducks to disturbance (Clarkson 1992, Hunt 1993). Only six commercial trips took place there in 1986, but increased to over 1500 trips/year by 1990 (Clarkson 1992, Hunt 1993). This was significantly correlated with declining Harlequin Duck numbers during the period 1986-1992 (Hunt 1993). Additionally, the mean monthly abundance of Harlequin Ducks is significantly and negatively correlated with the number of rafting trips per month (May, June, July) from 1986-92 (Hunt 1993).

On the Maligne River in 1993, Harlequins were displaced by rafts in 87% of 91 encounters; duck reactions included flying (60%) and swimming (19%) away from the rafts (Clarkson 1992). Birds usually took flight if a raft was on a collision course with a bird, was within 1-15 m of a bird, or if the raft crew was acting "boisterously" as they passed the duck (Clarkson 1992). Hunt (1993) recommended closure of the river to rafting in an attempt to restore historic population levels of Harlequins. He listed other less commercially disruptive actions which could possibly help stem the decline in Harlequins, including: 1) reducing the

amount of time each day that rafting was permitted; 2) reducing the number of allowed launch times each day; and 3) reducing the length of the river use season (Hunt 1993).

On the Bow River in Banff National Park, reaction to canoes by Harlequins was considerably less (Smith 1996). In 158 encounters, 62.6% of ducks had no reaction, 16.5% swam away, 11.4% flew away, and 9.5% hid (Smith 1996). The considerable difference in reactions between ducks on the Bow and Maligne Rivers is probably due to the fact that the Bow is substantially wider and splits in channels in numerous locations (Smith 1996).

Cassirer and Groves (1991) reported that nesting appeared to occur on stream reaches above those used by rafts on the two regularly boated Harlequin Duck streams in Idaho. Heavy whitewater rafting is believed to have caused the extirpation of Harlequins on the Methow River in Washington (Brady pers. comm. *in* Clarkson 1994).

Noise. No data available.

Collecting and trapping. Collecting permits have been issued in Montana (1), Washington, and Alaska. In Washington, a permit for 15 was issued as recently as 1992 and permits for up to 50 had been issued in previous years (Schirato 1993). There is a market for Harlequins in the avicultural trade, with pairs valued at $2,000 or more (C. Pilling, aviculturalist, pers. comm., *in* Harlequin Duck Working Group 1993).

In Iceland, egg collecting was extensively carried out in some areas through the mid-1960s, both for consumption and for breeding purposes; egg collecting is now prohibited (Bengtson 1972).

Capture of 465 Harlequin Ducks in British Columbia coastal waters resulted in 5 mortalities, 3 by drowning and two by heat prostration (Clarkson and Goudie 1994). In Montana, the mist-netting of over 250 Harlequins on breeding streams has resulted in 1 duckling death and in 1 adult leg injury.

Shooting. Hunting was the likely cause of the decline of the eastern North American Harlequin Duck population (Philips 1925, Palmer 1949). This was likely due to the fact that they are less wary than other sea ducks while on the coast (Philips 1925, Palmer 1976) and the fact that they forage in shallow water close to shore.

In Alaska, Harlequins are harvested by both recreational and subsistence hunters (Rothe 1994). The extent of hunting in the Pacific North American population appears to be low, with the exception of a few local areas in Alaska. No band returns from hunting have been reported out of more than 249 birds banded on breeding areas of Montana; however, a banded bird was found to have holes in the webbing of the foot apparently caused by pellets from a shotgun (Reichel and Genter 1994).

Fishing. Harlequins have been found entangled in fishing line in Glacier National Park on McDonald Creek (Ashley 1994) and in Jasper National Park on Maligne Lake (Clarkson 1992). A Harlequin has also been found with a fish hook lodged in its throat (Cassirer, pers. comm. *in* Clarkson 1992).

Pesticides and other contaminants/toxics. Thousands of Harlequins were killed or injured as a result of the *Exxon Valdez* oil spill of 24 March 1989 (Patten 1993 *in* Clarkson 1994). Later, productivity in western Prince William Sound, where oil remained, was nearly zero during 1989-1993; reproduction, however, was substantial in portions of eastern Prince William Sound which were not directly affected by the oil spill (Patten 1994). Petrochemicals were found in the proventriculus, liver and bile in Harlequins in western Prince William Sound and southwestern Kodiak Island; these were probably introduced via feeding on blue mussels (*Mytilus adulis*), an important food of Harlequins (Patten 1994). A relatively small oil spill in

1991 by the *Tenyu Maru* threatened approximately 10% of the Harlequins wintering in Washington (G. Schirato pers. comm. *in* Clarkson 1994). Even in the remote western Aleutian Islands where most Harlequin winter, sparse but wide-spread oil pollution is a potential threat (Byrd *et al.* 1992).

Wintering Harlequins concentrate in several areas along the Pacific coast for feeding and molting. Among these concentration areas is the east shore of Vancouver Island where toxic pollutants are abundant (Waldichuk 1983 *in* Clarkson 1994). Additionally, commercial, industrial, and recreational development are growing rapidly in this area.

Degradation of habitat: breeding and wintering.

Breeding. In 1992, a gas pipeline project was started which crosses the Moyie River in Idaho 8 times (Cassirer 1995). Because Harlequins were known to use this stream, a study was begun when siltation was noted from construction. The study showed that he siltation caused a decline in the Harlequins' macroinvertebrate food source; no young were successfully raised that year (Cassirer 1995). Recovery of macroinvertebrates was expected to occur within a year; indeed, Harlequins successfully bred the following year. The effects of the construction could have been minimized if the work had been done in late summer (after 1 September) or fall. The long term effect of the loss of one year's production on this already small population is yet not known (Cassirer 1995). However, Harlequins did attempt to breed (unsuccessfully) despite the disturbance and did not move to nearby streams.

MANAGEMENT

Federal

Fish and Wildlife Service. Neither the Atlantic nor Pacific populations are listed as Threatened or Endangered in the United States. The Harlequin Duck was listed as a Category 2 Candidate Species prior to 1996 at which time that Category was administratively eliminated. It is legally hunted in the Pacific states and provinces under the Migratory Bird Treaty Act and under state, provincial and federal regulations. Hunting is closed on the Atlantic flyway.

National Park Service. A seasonal boating closure was instituted on McDonald Creek above Lake McDonald in Glacier National Park in 1995 to protect Harlequin Ducks; the stream is closed to boating from 1 April though 30 September (J. Ashley pers. comm.). To protect wildlife, no boating on rivers is allowed in Yellowstone National Park. No U.S. National Park Service management plan exists for the Harlequin Duck.

Forest Service. The Harlequin Duck is a Sensitive Species in the Northern, Rocky Mountain, and Pacific Northwest Regions. Forest Service policy states that Sensitive Species should be managed to ensure that populations do not become Threatened or Endangered.

States/Heritage Programs. The Harlequin Duck is classified as a state sensitive species in Oregon, a priority habitat species in Washington, and a species of special concern in Idaho and Montana.

Other legal status. The Atlantic population of the Harlequin Duck is listed as Endangered by the Canadian Wildlife Service.

Mitigation procedures. None found.

PRIORITIES FOR FUTURE RESEARCH

The following are among the top future research priorities and are primarily a subset of those listed by the Harlequin Duck Working Group (1993) and by Cassirer *et al.* (1996). The Montana Natural Heritage Program has developed research proposals to address the priorities for those questions associated with the breeding grounds and migration and is pursuing funding for them; these are available from the Natural Heritage Program.

1) What are the impacts of human disturbance on breeding and wintering Harlequin Ducks?

Several independent studies have documented the sensitivity of Harlequin Ducks to human disturbance, primarily through the relationship of sighting locations to the accessibility of those locations (Kuchel 1977, Wallen 1987, Diamond and Finnegan 1993, Cassirer and Groves 1991, 1994, Clarkson 1992, Ashley 1994). Specifically, boating has been shown to have a significant negative correlation with numbers of ducks present in one area on a medium-sized stream (Clarkson 1992, Hunt 1993). Observations in other areas tend to support this conclusion (Cassirer and Groves 1991, Brady pers. comm. *in* Clarkson 1992) though it may not be the case in very large streams (Smith 1996). Fishing and human presence have also been suggested as causes of disturbance; however, though specific examples exist for both disturbances, statistical data analyses are lacking (Wallen 1987, McEneaney 1994, Cassirer and Groves 1991).

Other than for boating (Clarkson 1992, Hunt 1993), wide-scale analyses have not yet been attempted nor have analyses of the effects of most specific kinds and amounts of human activities. Several specific studies should be performed to address these questions.

Initially, wide-scale data on Harlequin streams is required, including productivity; population size; length of stream segments used during pair and brood seasons; categories and locations of land ownership of the streams; hydrogeological properties of the streams; habitat characteristics of the streams; and current human use of the stream (by roads, trails, structures, activity, etc.). A first step will be to see which of this information is already available and what is lacking that needs to be gathered in the field. For example, data regarding population size and length of stream segments used is already in place, while data regarding hydrogeological properties, habitat of the streams, and current human use will require preliminary information gathering to determine what is available. Unused and/or unknown streams that fit physical parameters of used streams can then be selected and compared in respect to kind and amounts of disturbance/accessibility.

Following wide-scale analyses, Harlequin response to humans requires evaluation; initial responses to surveyors could be recorded. Note that this would only provide immediate, in-sight response of birds seen; presumably some birds would react prior to the surveyor seeing them and thus not be observed at all. Nor would such a study reveal length of time or distance moved in reaction to disturbance. A more precise but intrusive method would be to use radiotelemetry on the birds. Radio-telemetry would additionally provide more accurate data on use of habitat types and locations relative to human development/access points.

Finally, when actions are taken on Harlequin streams, monitoring to determine effects of those actions should be implemented, thereby providing for adaptive management and prevention of future mistakes. Specific land management or development actions on Harlequin streams should be proceeded by at least two years of baseline marking and surveying for population size

and productivity, areas used at different seasons, habitat evaluation, and pre-action levels of human activity and development. Monitored should continue to occur during and following the action. Actions which particularly need attention include road, campsite, and trail construction and upgrading, including any increased accessibility and changes in human use of the area; actions which could result in changes to flow regimes or water quality, such as mining, road building, timber harvest, industrial development, and water/hydroelectric development; changes in fishing regulations which could change fishing use of the area; and building of structures such as industrial areas, dams, or houses which will increase the access and use of a Harlequin stream. Possibilities for mitigation and habitat restoration can be explored during these projects.

2) What is the extent and nature of movements in breeding and wintering areas?

This information is needed to determine the possibilities for naturally recolonizing new and historic Harlequin occurrences; naturally supplementing existing occurrences, particularly small populations; and the strength of natal and adult fidelity to particular sites. This information is necessary in order to successfully model Harlequin populations and their stability, with both breeding and wintering grounds data incorporated.

Radio-telemetry may give quick results from the standpoint of local daily movements; however, long distance (>5 km) movements may be relatively rare, and with limited numbers of ducks radioed, may not be best for long distance movement detection. For long distance and moves between years, visibly marking birds is best.

Determining fidelity to natal areas will be a long term project; Montana has the strongest start, with 250 birds banded on the breeding grounds since 1992. Sufficient information for preliminary modeling should be available following the 1996 field season. Sufficient information for final modeling could then be available following the 1998 field season, if funding is continued for the project to that point.

Much data is now available in relation to wintering grounds movements and additional data is currently being collected in Washington, Alaska, and British Columbia. Sufficient information for use in detailed population modeling should be available within 2 years. For an accurate model, information is necessary from both the breeding and wintering grounds.

3) Are distinct metapopulations (such as a Rocky Mountain breeding population) identifiable within the Pacific range of the Harlequin Duck?

A knowledge of the degree of genetic differences among and within wintering and breeding subpopulations would allow an assessment of the appropriate management units for various Harlequin conservation strategies. Dan Esler, Alaska National Biological Service, is currently examining this question, primarily as it applies to wintering areas.

4) What are the critical habitat components limiting Harlequin Duck breeding and wintering populations?

Harlequin Ducks use a wide variety of habitats on the breeding grounds, from forests to tundra. Habitat usage should be documented over a large number of study areas to identify common habitat components for comparison to available habitat; both large and small scale components should be considered.

5) How and why do productivity and survival change over time and different areas, and what are the relative impacts of these changes on populations?

Long term studies are needed to determine population parameters for incorporation into population models (with information from movements on the breeding and wintering grounds). Needed population parameters include: productivity; age-related survival; recruitment; age(s) at first breeding and/or successful breeding; age(s) last breeding; life expectancy; and causes and timing of mortality. This information can only be provided via long-term studies involving marked birds on both the breeding and wintering areas. We are currently in an optimum position to complete studies needed on the breeding grounds, with 4 years of data on the Montana breeding population. Combined with the continued marking and study of coastal populations by Alaska, Washington, Oregon, and British Columbia, many of these parameters may be known by the end of 1997.

The most difficult question to be answered involves the causes of mortality, which is not tractable given current technology. If and when small, long range mortality transmitters are available for ducks, this topic should be pursued.

6) What are the characteristics of Harlequin Duck migration? How well defined are migratory staging areas and migration corridors?

This question may not be tractable given current technology. If and when small, long range mortality transmitters are available for ducks, this topic should be pursued. Some answers may come from large scale marking of individuals, and perhaps by relocating radioed birds.

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Appendices

Appendix A.

Data Forms

Harlequin Duck Survey Form. ___ of ___

Date_____ Time_____ Surveyor(s)_____
(Start/Finish)

Stream_____
Include map with exact area(s) surveyed on back of this page

Weather_____
(Temp., wind dir & speed, cloud cover, precip last 24 hrs)

Accessibility?_____
==========

Group #_____ # Individuals_____
(Put on map)

Sexes & Ages_____

Marked?_____

Accessibility?_____

Group #_____ # Individuals_____
(Put on map)

Sexes & Ages_____

Marked?_____

Accessibility?_____

Group #_____ # Individuals_____
(Put on map)

Sexes & Ages_____

Marked?_____

Accessibility?_____

NOTES:

Harlequin Duck Banding Form.

Date____________ Location____

Sex____ Age____ T_____N, R_____W, Section_________________

Nasal Saddles Color Bands

Band #____________ Lft___________ Rt____________ Lt_______ Rt_________

Weight________ Wing chord________ Tail___________ Tarsus_________

Molt____

Notes____

(with other ducks? marked, sex, age? etc.)

+++

Date____________ Location____

Sex____ Age____ T_____N, R_____W, Section_________________

Nasal Saddles Color Bands

Band #___________ Lft___________ Rt____________ Lt_______ Rt________

Weight__________ Wing chord________ Tail__________ Tarsus_________

Molt____

Notes____

(with other ducks? marked, sex, age? etc.)

+++

Date____________ Location____

Sex____ Age____ T_____N, R_____W, Section_________________

Nasal Saddles Color Bands

Band #___________ Lft___________ Rt____________ Lt_______ Rt________

Weight________ Wing chord________ Tail___________ Tarsus_________

Molt____

Notes____

(with other ducks? marked, sex, age? etc.)

+++

NOTES:

HARLEQUIN DUCK OBSERVATION FORM

(Record data for the site where ducks are first seen!)

Date_____ Time_____ Stream_____ Observer_____ Survey/Casual

UTM-N_____ UTM-E_____ T_____ R_____ S_____ 1/4_____

INDIVIDUALS	LEG BANDS (L top/bottom, R top/bottom)	NASAL DISCS (L:R)
1. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____
2. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____
3. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____
4. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____
5. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____
6. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____
7. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____
8. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____
9. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____
10. Sex__ Age__	__/__ __/__ Legs not seen__ No bands__	_____:_____

ACTIVITY	HABITAT	LOCATION	SUBSTRATE	CHANNEL TYPE
		IS island		
LO loafing	BA backwater	LO loaf	CL clay	ST straight
SW swimming	PO pool	BA bank	SA sand	ME meander
SF swim/feed	RI riffle	ED edge	GR gravel	CU curved
FL flying	GL glide	BT bank 1/3	CO cobble	BR braided
OT other	RU run	CE center	BO boulder	AB abandoned
	RA rapid	EY eddy	BE bedrock	
	PW pocketwater	PD pond		

BANK COMP.	OVERSTORY AGE	HUMAN ACCESS	DEBRIS WITHIN 10m OF DUCK
TR trees	SE seedling	AD adjacent	Loafing sites 0 1 >1 __
SH shrub	SA sapling	NE near	Ramp 0 1 >1 __
GF grass/forb	PO pole	AC accessible	Drift 0 1 >1 __
TS tree/shrub	IM immature	IN inaccessible	Bridge 0 1 >1 __
SA sand	MA mature		Collapsed br. 0 1 >1 __
SI silt	OG old-growth		
GR gravel			
BE bedrock			

Stream depth (m)_____ Bank undercut? Y N Stream velocity:

Stream width (m)_____ Overhanging vegetation? Y N _____ _____ _____

COMMENTS

STREAM HABITAT

Backwater - slow water area out of main stream channel
Pool - deep, slow water area in the stream
Riffle - shallow area where the surface is influenced by the stream bottom
Glide - run area with velocity < 0.3 m/sec
Run - deeper than a riffle, no whitewater, too fast to be a glide or a pool, velocity > 0.3 m/sec
Rapid - whitewater, deep fast water, influenced by stream bottom and/or bank
Pocketwater - a run or riffle with boulders (>30 cm in diameter) which create numerous small pools

LOCATION

Loaf - loafing on a rock or log
Bank - on the streambank
Edge - at the very edge of the stream next to the bank, in the bank eddy
Bank 1/3 - beyond edge but in the third of the stream closest to the bank
Center - in the water in the center 1/3 of the stream, not in an eddy
Eddy - in an eddy created by a rock or a log

SUBSTRATE

Gravel - 0.2-7 cm (0.1-3") diameter
Cobble - 8-30 cm (3-12")
Boulder - >30 cm
Bedrock - no loose fill

CHANNEL TYPE

Straight - Stream channel linear, structurally controlled by a "V" shaped valley, no movement of channel during peak flows
Meander - Channel follows sinuous curves, deep pools seperated by shallow riffles, appears to shift slightly during peak flows
Curved - Stream channel curves or zig-zags more abruptly than a meander, channel structurally controlled by a "V" shaped valley, no movement of channel during peak flows
Braided - Channel located in flat-bottomed valley, midstream bars occur and divide the stream into several intersecting and shifting channels

OVERSTORY AGE

Seedling - 1-10 yrs old, < 4.5' tall
Sapling - 10-40 yrs old, DBH < 5"
Pole - 40-70 yrs old, DBH 5-9"
Immature - 70-100 yrs old, DBH 9-14"
Mature - 100-160 yrs old, DBH 14-20"
Old growth - >160 yrs old, DBH >20"

HUMAN ACCESS

Adjacent - established area of human activity maintained within 10m of bank
Near - established area of human activity maintained within 10-50m of bank
Accessible - >50 m from human activity, accessible by car or trail
Inaccessible - >50 m from human activity, not accessible by car or trail

DEBRIS

Bridge - log across stream
Collapsed bridge - log across stream, collapsed in middle of stream
Ramp - one end of log in stream, other end on the bank
Drift - log in stream that is not close to either bank

LOAFING SITE - rock or log in stream completely surrounded by water, suitable for resting site
VEGETATIVE OVERHANG - vegetation over the stream within 12" of water surface

Appendix B.

Harlequin Streams in Montana:

Actual, Possible, and Potential

Appendix B, Table 1. Montana harlequin duck breeding and probable breeding occurrences, 1995.

Occurrence	Status	Rank	Watershed	Primary ownership
Waterton River	B	CB	South Saskatchewan River	GNP
includes Kootenai Lakes	PRB			
Boundary Creek	PRB			
Olson Creek	B			
St. Mary River (above Lake)	B	CB	St. Mary River	GNP
includes St. Mary River	PRB			
Reynolds Creek	B			
Red Eagle Creek	B			
Rose Creek and Otokomi Lake	BU			
Belly River	PRB	U	St. Mary River	GNP
Badger Creek	B	CB	South Marias River	LCNF
includes North Badger Creek	B			
South Badger Creek	B			
Birch Creek	B	CB	South Marias River	LCNF
includes Birch Creek	PRB			
North Fork Birch Creek	PRB			
Middle Fork Birch Creek	PRB			
South Fork Birch Creek	B			
South Fork Two Medicine River	B	D	South Marias River	LCNF
includes Summit Creek	BU			
Two Medicine River	PRB	D	South Marias River	GNP,
includes Paradise Creek	PRB			BIR
North Fork Teton River	B	DC	Teton River	LCNF
Sun River	B	BA	Sun River	LCNF
includes Sun River	BU			
North Fork Sun River	B			
Biggs Creek	BU			
Moose Creek	B			
South Fork Sun River	B			
Straight Creek	B			
West Fork Sun River	B			
Ahorn Creek	PRB			
Woods Creek	BU			
Boulder River	B	CB	Yellowstone River	GNF
Lake Fork Rock Creek	PRB	DC	Clarks Fork Yellowstone	CNF

Appendix B, Table 1, cont. Montana harlequin duck breeding and probable breeding occurrences, 1995.

Occurrence	Status	Rank	Watershed	Primary ownership
Big Creek	B	D	Kootenai River	KNF
Callahan Creek	B	D	Kootenai River	KNF
includes Callahan Creek	BU			
North Fork Callahan Creek	B			
Grave Creek	B	C	Kootenai River	KNF
Kootenai Falls	H	U	Kootenai River	KNF
Quartz Creek	B	D	Kootenai River	KNF
Wigwam River	PRB	U	Kootenai River	KNF
West Fork Yaak River	B	DC	Yaak River	KNF
Middle Fork Rock Creek	B	DC	Rock Creek	DNF
Big Creek	PRB	D	North Fork Flathead River	FNF
Upper North Fork Flathead River	B	BC	North Fork Flathead River	GNP, FNF
Includes Kishenehn Creek	B			
Trail Creek	B			
McDonald Creek	B	AB	Middle Fork Flathead River	GNP, FNF
includes Avalanche Creek	B			
Mineral Creek	B			
Snyder Creek	PRB			
Sprague Creek	BU			
Fish Creek	PRB			
Middle Fork Flathead R. (lower)	B			
Middle Fork Flathead River	B	CD	Middle Fork Flathead River	FNF, GNP
includes Bear Creek	BU			
Ole Creek	BU			

[1] B = Breeding, PRB = Probable breeding, BU = Breeding status unknown.

[2] A = 20+ pairs within a single occurrence, B = 5 - 19 pairs within the occurrence and a minimum of 10 pairs within the occurrence and other occurrences within 40 km, C = 3+ pairs within the occurrence; if 5+ pairs then <10 pairs within the occurrence and other occurrences within 40 km. D = 1-2 pairs, U = Unknown. Not enough data to place in a range of 2 categories.

[3] CNF = National Forest, DNF = Deerlodge National Forest, FNF = Flathead National Forest, GNP= Glacier National Park, KNF = Kootenai National Forest.

Appendix B, Table 1, cont. Montana harlequin duck breeding and probable breeding occurrences, 1995.

Occurrence	Status	Rank	Watershed	Primary ownership
Upper South Fork Flathead River	B	BC	South Fork Flathead River	FNF
includes White River	B			
Little Salmon Creek	B			
Spotted Bear River	B	CD	South Fork Flathead River	FNF
Sullivan Creek	B	D	South Fork Flathead River	FNF
Wounded Buck Creek	B	D	South Fork Flathead River	FNF
Swift Creek	PRB	DC	Stillwater River (north)	MTSL
North Fork Blackfoot River	B	C	Blackfoot River	LNF
includes Dry Fork of N. Fork Blackfoot	BU			
East Fork North Fork Blackfoot	BU			
Rattlesnake Creek	PRB	DC	Middle Clark Fork	LNF
Trout Creek	B	D	Middle Clark Fork	LNF
Elk Creek	PRB	D	Lower Clark Fork	KNF
Noxon	B	BA	Lower Clark Fork	KNF
includes Marten Creek	B			
South Fork Marten Creek	B			
South Branch Marten Creek	BU			
McNeeley Creek	BU			
Rock Creek	B			
East Fork Rock	BU			
West Fork Rock	BU			
Swamp Creek	B			
Vermilion River	B			

[1] B = Breeding, PRB = Probable breeding, BU = Breeding status unknown.

[2] A = 20+ pairs within a single occurrence, B = 5 - 19 pairs within the occurrence and a minimum of 10 pairs within the occurrence and other occurrences within 40 km, C = 3+ pairs within the occurrence; if 5+ pairs then <10 pairs within the occurrence and other occurrences within 40 km.
D = 1-2 pairs, U = Unknown. Not enough data to place in a range of 2 categories.

[3] FNF = Flathead National Forest, MTSL= Montana Dept. of State Lands, KNF = Kootenai National Forest, LNF = Lolo National Forest.

Appendix B, Table 2. Montana streams where harlequin ducks have been observed or reported, but current breeding status is unknown.

Stream	Watershed	Primary ownership[1]	No. surveys conducted
Otatso Creek includes Slide Lake	St. Mary River	GNP	0
Cut Bank Creek	Cut Bank Creek	BIR	0
South Fork Teton River	Teton River	LCNF	3
Upper Madison River	Madison River	GNF	0
Elk Creek includes East Fork Elk Creek West Fork Elk Creek	Upper Yellowstone River	GNF	1
Mill Creek	Upper Yellowstone River	GNF	1
Sweet Grass Creek	Upper Yellowstone River	GNF	0
Rock Creek includes West Fork Rock Creek	Clarks Forks Yellowstone	CNF	0
West Fork Stillwater	Stillwater River (south)	CNF	1
Lake Creek	Kootenai River	KNF	1
Seventeenmile Creek	Yaak River	KNF	5
Clearwater River	Blackfoot River	LNF	0
Willow Creek	Blackfoot River	HNF	0
Cache Creek	Middle Clark Fork	LNF	0
Twelvemile Creek	Middle Clark Fork	LNF	2
North Fork Flathead River (south of Trail Creek)	North Fork Flathead River	GNP, FNF	5
Red Meadow Creek	North Fork Flathead River	FNF	3
Whale Creek	North Fork Flathead River	FNF	5

[1] BIR = Blackfeet Indian Reservation, BNF = Bitterroot National Forest, CNF = Custer National Forest, FNF = Flathead National Forest, GNF= Gallatin National Forest, GNP = Glacier National Park, KNF = Kootenai National Forest, LCNF = Lewis Clark National Forest, LNF = Lolo National Forest.

Appendix B, Table 2 cont. Montana streams where harlequin ducks have been observed or reported, but current breeding status is unknown.

Stream	Watershed	Primary ownership[1]	No. surveys conducted
Starvation Creek	North Fork Flathead River	GNP	0
Middle Fork Flathead River sections between and above known sites	Middle Fork Flathead River	GNP, FNF	3
Granite Creek	Middle Fork Flathead River	FNF	0
Lincoln Creek	Middle Fork Flathead River	GNP	1
Nyack Creek	Middle Fork Flathead River	GNP	0
Bunker Creek	South Fork Flathead River	FNF	5
South Fork Flathead River includes sections above reservoir not included in Appendix B, Table 1.	South Fork Flathead River	FNF	5
Jocko River	Lower Flathead River	FIR	0
Stillwater River	Stillwater River (northern)	MDSL KNF	4
Bull River upper stretches of major forks	Lower Clark Fork	KNF	1-3
Deep Creek	Lower Clark Fork	LNF	0
Fishtrap Creek	Lower Clark Fork	LNF	5
Graves Creek	Lower Clark Fork	LNF	9
White Pine Creek	Lower Clark Fork	KNF	1

[1] BIR = Blackfeet Indian Reservation, BNF = Bitterroot National Forest, CNF = Custer National Forest, FNF = Flathead National Forest, GNF= Gallatin National Forest, GNP = Glacier National Park, KNF = Kootenai National Forest, LCNF = Lewis Clark National Forest, LNF = Lolo National Forest.

Appendix B. Table 3. Partial list of potential harlequin duck breeding streams in Montana.

Stream	Watershed	Primary ownership[1]	No. surveys conducted
Sherburne River	St. Mary River	GNP	0
Middle Fork Teton River	Teton River	LCNF	0
Pattengail Creek	Wise River	BNF	0
West Fork Madison River	Madison River	GNF	1
Taylor Fork Gallatin River	Gallatin River	GNF	1
Upper Boulder River	Boulder River	DNF	0
Milk River (upper forks)	Milk River	BIR	0
West Fork Teton River	Teton River	LCNF	1
Dearborn River (& forks)	Dearborn/Missouri Rivers	LCNF	3
Forks of Boulder River	Upper Yellowstone River	GNF	2-4
Hellroaring Creek	Upper Yellowstone River	GNF	0
Slough Creek	Upper Yellowstone River	GNF	0
Big Creek	Upper Yellowstone River	GNF	1
Rock Creek	Upper Yellowstone River	GNF	0
Rosebud Creek	Stillwater River (south)	CNF	2
Stillwater River (& forks)	Stillwater River (south)	CNF	4
South Fork Callahan Creek	Kootenai River	KNF	4
Keeler Creek	Kootenai River	KNF	2
Fish Creek (& forks)	Middle Clark Fork River	LNF	0
Anaconda Creek	North Fork Flathead River	GNP	0
Bowman Creek	North Fork Flathead River	GNP	1
Camas Creek	North Fork Flathead River	GNP	0
Kintla Creek	North Fork Flathead River	GNP	2

[1] BIR = Blackfeet Indian Reservation, BNF = Bitterroot National Forest, CNF = Custer National Forest, FNF = Flathead National Forest, GNF= Gallatin National Forest, GNP = Glacier National Park, KNF = Kootenai National Forest, LCNF = Lewis Clark National Forest, LNF = Lolo National Forest.

Appendix B. Table 3, cont. Partial list of potential harlequin duck breeding streams in Montana.

Stream	Watershed	Primary ownership[1]	No. surveys conducted
Quartz Creek	North Fork Flathead River	GNP	0
Coal Creek	Middle Fork Flathead River	GNP	0
Dolly Varden Creek	Middle Fork Flathead River	FNF	2
Morrison Creek	Middle Fork Flathead River	FNF	1
Park Creek	Middle Fork Flathead River	GNP	0
Schafer Creek	Middle Fork Flathead River	FNF	2
Bunker Creek	South Fork Flathead River	FNF	5
Trout Creek	Lower Clark Fork River	KNF	3
Jocko River			

[1] FNF = Flathead National Forest, GNP = Glacier National Park, KNF = Kootenai National Forest.

Appendix C.

Montana Harlequin Duck surveys: 1995

Appendix C. Montana Harlequin Duck surveys 1995.

Drainage: Hydrologic Code
Stream

Upper end	Lower end	Date	kms	M	F	J	U	Pr	Source Code
UPPER YELLOWSTONE RIVER DRAINAGE: 100700									
Stillwater River Drainage: 10070005									
Rosebud Creek, West									
T07S R16E S01 NW	T05S R17E S35 SW	7-8 Aug 1995	24						Reichel and Genter 1996
Rosebud Creek, West									
T07S R17E S16 SW	T07S R17E S02 SE	8 Aug 1995	9						Reichel and Genter 1996
Clark's Fork of the Yellowstone River Drainage: 10070006									
Rock Creek (tributaries covered separately)									
T09S R19E S25 NW	T08S R19E S36 Sw	11 Aug 1995	22						Reichel and Genter 1996
Rock Creek, Lake Fork									
T08S R18E S32	T08S R19E S34 SW	10 Aug 1995	19						Reichel and Genter 1996
Rock Creek, West Fork									
T07S R18E S34 SW	T08S R19E S11 NE	9 Aug 1995	21						Reichel and Genter 1996
KOOTENAI RIVER DRAINAGE: 170101									
Upper Kootenai River Drainage: 17010101									
Big Creek									
T34N R30W S20	T34N R29W S3	7 May 1994	18						Reichel and Genter 1996
Callahan Creek									
confluence forks	T31N R34W S20NE	30 Apr 1995	4						Reichel and Genter 1996
confluence forks	Troy	12 May 1995	14						Reichel and Genter 1996
confluence forks	Troy	10 Jul 1995	14						Reichel and Genter 1996
S Fork									
T59N R35W S26 SW	confluence forks	12 May 1995	5						Reichel and Genter 1996
N Fork									
564300E 536800N	confluence forks	30 Apr 1995	11	1					Reichel and Genter 1996
T59N R03E S21 NW	confluence forks	9 Jul 1995	10		1				Reichel and Genter 1996
Grave Creek									
T37N R24W S32 SW	T36N R25W S12 SW	1 May 1995	6						Reichel and Genter 1996
T36N R25W S12 SW	T35N R26W S12 NE	1 May 1995	14					4	Reichel and Genter 1996
T36N R25W S01 NE	T35N R26W S12 NE	31 Jul 1995	18		2	5 (2br)	2		Reichel and Genter 1996
Keeler Creek									
T30N R34W S30 SE	T30N R34W S27 NW	11 May 1995	6						Reichel and Genter 1996
Kootenai River (tributaries covered separately)									
Kootenai Falls									
	T31N R33W S13 NW	11 May 1995	0.5						Reichel and Genter 1996
T31N R33W S13 NE	T31N R33W S13 NW	17 Jul 1995	1						Reichel and Genter 1996
Libby Creek									
T28N R31W S25 SE	T28N R30W S04 NW	17 Jul 1995	16						Reichel and Genter 1996
Quartz Creek									
T31N R32W S2 SE	T31N T32W S24 NW	30 Apr 1995	6						Reichel and Genter 1996

Appendix C (cont). Montana Harlequin Duck surveys 1995.

Drainage: Hydrologic Code / Stream / Upper end	Lower end	Date	kms	M	F	J	U	Pr	Source Code
Fisher River Drainage: 17010102									
West Fisher River									
T54N R30W S03 SW	T27N R29W S31 N	17 Jul 1995	10						Reichel and Genter 1996
Yaak River Drainage: 17010103									
Seventeenmile Creek									
T33N R32W S10 SE	T34N R33W S27 SE	19-20 Jul 1995	16						Reichel and Genter 1996
Spread Creek									
T36N R33W S30 NE	T35N R33W S03 S	19 Jul 1995	9						Reichel and Genter 1996
Yaak River, North Fork (tributaries covered separately)									
T37N R31W S10 NW	T37N R31W S23 NW	18 Jul 1995	5						Reichel and Genter 1996
Yaak River, West Fork									
T37N R32W S15 SE	T37N R31W S32 NW	18 Jul 1995	13		1	2			Reichel and Genter 1996
CLARK FORK RIVER DRAINAGE: 170102									
Blackfoot River Drainage: 17010203									
Blackfoot River, Lander's Fork									
T16N,R08W,S07 SWSE	T14N,R08W,S12	25 May 1995	26						Reichel and Genter 1996
Blackfoot River, North Fork									
T17N R10W S15 NENW	T17N R10W S29 SE	26 May 1995	5					1	Reichel and Genter 1996
T17N R10W S2 NE	T17N R10W S15 NENW	28 May 1995	6					3	Reichel and Genter 1996
North Fork Blackfoot River, Dry Fork									
T17N R11W S13 NW	T17 R10W S31 NE	29 May 1995	8						Reichel and Genter 1996
North Fork Blackfoot River, East Fork									
T16N R09W S07 NW	T17 R10W S28 SW	27 May 1995	14					1	Reichel and Genter 1996
Copper Creek									
T15N R08W S05 NW	T15N R08W S36 SENW	24 May 1995	16						Reichel and Genter 1996
Middle Clark Fork River Drainage: 17010204									
Trout Creek									
T15N R26W S18 SW	T16N R26W S14 SW	12 Jul 1995	19						Reichel and Genter 1996
North Fork Flathead River: 17010206									
Trail Creek									
T37N,R23W,S25 SESW	T37N,R22W,S35 SESE	8 May 1995	15	2				6	Reichel and Genter 1996
T37N,R23W,S25 NWSE	T37N,R22W,S35 SESE	30 Jul 1995	14						Reichel and Genter 1996
Whale Creek									
T36N,R22W,S20 SE	T36N,R21W,S30 SW	98 May 1995	10						Reichel and Genter 1996

Appendix C (cont). Montana Harlequin Duck surveys 1995.

Drainage: Hydrologic Code / Stream / Upper end	Lower end	Date	kms	M	F	J	U	Pr	Source Code
South Fork Flathead River Drainage: 17010209									
Spotted Bear River									
T25N,R13W,S7 SW	T25N,R15W,S17 SW	17 May 1995	19	1					Reichel and Genter 1996
T25N,R13W,S16 NW	T25N,R13W,S08 SE	1 Aug 1995	3						Reichel and Genter 1996
T25N,R13W,S08 SE	T25N,R15W,S17 SW	2 Aug 1995	20		2	5(1 br)			Reichel and Genter 1996
Sullivan Creek									
T26N,R16W,S31 NE	T26N,R17W,S1 NENE	16 May 1995	13	1	1			1	Reichel and Genter 1996
T26N,R16W,S31 NE	T26N,R17W,S1 NENE	1 Aug 1995	13		1				Reichel and Genter 1996
Stillwater River Drainage: 17010210									
Stillwater River									
T34N R24W S05 SW	T34N R25W S25 SE	5 Jul 1995	16						Reichel and Genter 1996
Swift Creek									
T33N R23W S24 SW	T32N R22W S30 SE	31 May 1995	15	2					Reichel and Genter 1996
T33N R23W S24 SW	T31N R22W S05 NW	6 Jul 1995	20						Reichel and Genter 1996
Lower Clark Fork River Drainage: 17010213									
Marten Creek									
T25N,R32W,S32	T25N,R33W,S32	26 Apr 1995	16	2				3	Reichel and Genter 1996
T25N,R33W,S28	T25N,R32W,S31	10 Jul 1995	10		3				Reichel and Genter 1996
T25N R33W S26	T25N R32W S32	29 July 1994	6		1	11(2 br)			Reichel and Genter 1996
North Branch Marten Creek									
T25N,R32W,S32	T25N,R32W,S32	26 Apr 1995	0.5						Reichel and Genter 1996
South Branch Marten Creek									
T25N,R32W,S31 NE	T25N,R32W,S32	26 Apr 1995	1						Reichel and Genter 1996
South Fork Marten Creek									
T24N,R33W,S11 SW	T25N,R32W,S31	27 Apr 1995	4	1					Reichel and Genter 1996
T24N,R33W,S11 SW	T25N,R32W,S31	10 Jul 1995	4			5			Reichel and Genter 1996
T24N,R33W,S11 SW	T25N,R32W,S31	29 Jul 1995	4						Reichel and Genter 1996
Rock Creek									
T26N R32W S28	T26N R32W S2	28 Apr 1995	12	2					Reichel and Genter 1996
T26N R32W S28	T26N R32W S2	26 July 1995	10		1	5 (1 br)			Reichel and Genter 1996
Swamp Creek									
T26N,R31W,S27 SE	T25N,R31W,S20 NW	29 Apr 1995	10	1				3	Reichel and Genter 1996
T26N,R31W,S34 SE	T25N,R31W,S20 NW	27 Jul 1995	8		2	10 (2 br)			Reichel and Genter 1996
Trout Creek									
East Fork	Reservoir	28 Apr 1995	16						Reichel and Genter 1996
Vermilion River									
T25N R29W S33	T24N R31W S14	27 Apr 1995	18	3					Reichel and Genter 1996
T25N R29W S33	T24N R31W S14	11-12 July 1995	18		3	11 (2 br)			Reichel and Genter 1996
T25N R29W S33	T24N R31W S14	29 July 1995	18		2	5* (2 br)			Reichel and Genter 1996

* a female with a brood of 6 from Marten Creek was also seen

Appendix D.

List of Harlequin Ducks observed on surveys in 1995

List of Harlequin Ducks observed or marked in 1995 on surveys.

utm zone	N-utm	E-utm	Da	Mo	Year	Surv	single M	F	J	U	Observer	Comments
KOOTENAI RIVER DRAINAGE: 170101												
Upper Kootenai River Drainage: 17010101												
Callahan Creek												
11	5365000	571000	30	4	1995	Yes	1				CDC	
11	5365620	570000	9	7	1995	Yes		1			CDC	
Grave Creek												
11	5416000	660900	2	5	1995	Yes	1	1			JDR	pair
11	5414800	660500	2	5	1995	Yes	1	1			RF	pair
11	5411270	658700	2	5	1995	Yes	1	1			RF	pair
11	5409550	657250	2	5	1995	Yes	1	1			CDC	pair
11	5413580	659720	31	7	1995	Yes		1		2	CDC	
11	5417210	661430	31	7	1995	Yes		1	4		CDC	1 brood
11	5417130	661340	31	7	1995	Yes			1		DPH, R Kerr	
Yaak River Drainage: 17010103												
Yaak River, West Fork (tributaries covered separately)												
11	5420900	592950	18	7	1995	Yes		1	2		CDC	1 brood, Class IIB
CLARK FORK RIVER DRAINAGE: 170102												
Blackfoot River Drainage: 17010203												
Blackfoot River, East Fork of the North Fork (tributaries covered separately)												
12	5228280	357400	27	5	1995	Yes	1	1			CDC	pair
Blackfoot River, North Fork (tributaries covered separately)												
12	5230700	358690	26	5	1995	Yes	1	1			CDC	pair
12	5231620	358820	28	5	1995	Yes	1	1			CDC	pair
12	5223930	358820	28	5	1995	Yes	1	1			CDC	pair
12	5234110	360480	28	5	1995	Yes	1	1			CDC	pair
North Fork Flathead River Drainage: 17010206												
Trail Creek												
11	5423400	681290	8	5	1995	Yes	1	1			CDC	pair
11	5423730	682200	8	5	1995	Yes	1	1			CDC	pair

List of Harlequin Ducks observed or marked in 1995 on surveys.

utm zone	N-utm	E-utm	Da	Mo	Year	Surv	single M	F	J	U	Observer	Comments
11	5423850	683200	8	5	1995	Yes	1	1			CDC	pair
11	5423800	683400	8	5	1995	Yes	1	1			CDC	pair
11	5423520	683800	8	5	1995	Yes	1	1			CDC	pair
11	5423300	684100	8	5	1995	Yes	2				CDC	
11	5423220	685100	8	5	1995	Yes	1	1			CDC	pair
South Fork Flathead River Drainage: 17010209												
Spotted Bear River												
12	5312620	315430	17	5	1995	Yes	1				CDC	
12	5310650	327900	2	8	1995	Yes		1	5		CDC	1 brood
12	5310550	323590	2	8	1995	Yes		1			CDC	
Sullivan Creek												
12	5318670	298900	16	5	1995	Yes	1				CDC	
12	5319060	298860	16	5	1995	Yes		1			CDC	
12	5324600	299600	16	5	1995	Yes	1	1			CDC	pair
12	5321780	298000	1	8	1995	Yes		1			CDC	
Stillwater River Drainage: 17010210												
Swift Creek												
11	5378500	687200	31	5	1995	Yes	1				CDC	
11	5377250	688000	31	5	1995	Yes	1				CDC	
Lower Clark Fork River Drainage: 17010213												
Marten Creek												
11	5304780	589150	26	4	1995	Yes	1	1			CDC, DPH,R Fawcett, Jill, Rod, JDR	pair
11	5304820	587570	26	4	1995	Yes	1	3			CDC, DPH,R Fawcett, Jill, Rod, JDR	pair + 2 males
11	5304300	585550	26	4	1995	Yes	1	1			CDC, DPH,R Fawcett, Jill, Rod, JDR	pair
11	5304700	598950	11	7	1995	Yes		2			CDC	
11	5304370	586450	11	7	1995	Yes		1			CDC	
11	5303200	592950	28	7	1995	Yes			5		JDR	Class III
11	5303100	592670	28	7	1995	Yes		1	6		JDR	1 brood, Class IV
11	5303400	593100	27	7	1995	No		1	6		JDR	1 brood, Class IV
Marten Creek, South Fork												

List of Harlequin Ducks observed or marked in 1995 on surveys.

utm zone	N-utm	E-utm	Da	Mo	Year	Surv	single M	F	J	U	Observer	Comments
11	5302040	590500	27	4	1995	Yes	1				DPH, R Fawcett	
11	5301680	593570	10	7	1995	Yes			5		CDC	Class 1B
Rock Creek												
11	5314420	595420	26	7	1995	Yes		1	5		DPH,CDC	
11	5317820	596850	28	4	1995	Yes	2				DPH, R Faucett	
Swamp Creek												
11	5309750	604490	29	4	1995	Yes	1	1			JDR	pair
11	5310850	605000	29	4	1995	Yes	1				DPH	
11	5312300	605340	29	4	1995	Yes	1	1			R Faucett	pair
11	5311780	605200	29	4	1995	Yes	1	1			R Faucett	pair
11	5312800	605730	27	7	1995	Yes		1	6		CDC	1 brood
11	5312960	605800	27	7	1995	Yes		1	4		CDC	1 brood
Vermilion River												
11	5302800	620650	27	4	1995	Yes	1				CDC	
11	5302770	620000	27	4	1995	Yes	2				CDC	
11	5302830	619500	11	7	1995	Yes		1	6		CDC	1 brood, Class 1B
11	5302800	619000	11	7	1995	Yes		1	5		CDC	1 brood, Class 1A
11	5301760	615300	11	7	1995	Yes		1			CDC	
11	5302750	619650	29	7	1995	Yes		1	6		CDC	1 brood (flying) also seen and marked previous day on Marten Cree
11	5302593	617529	29	7	1995	Yes		1	3		CDC	1 brood Class 1IB
11	5300820	611860	29	7	1995	Yes		1	2		CDC	1 brood Class 1B

Appendix E.

Miscellaneous reports of Harlequin Ducks during 1995

Appendix E. Miscellaneous reports of Harlequin Ducks in Montana during 1995 and reports for prior years received during 1994.

Stream & Location	Date	Harlequins M	F	J	U	Pr	Br	Observer
Glacier National Park								
McDonald Creek, 2 mi above Lake McDonald	28 May 1995					2		Thomas Johannesmeyer
Kootenai National Forest								
Grave Creek, 30 m above Lewis Creek bridge	26 May 1990				1			Gene & Betty Holder
T36N R25W S29 [NOTE: section 29 is not on the creek]	1 Aug 1991				5			Kevin Ruble
0.1 mi above Blue Sky bridge	May 1994	1	1					Lynn Johnson
0.1 mi above Blue Sky bridge	June 1994		1					Lynn Johnson (bird banded)
0.1 mi above Blue Sky bridge	24 May 1995					1		Lynn Johnson
at bridge over Lewis Creek	24 May 1995	1						Lynn Johnson
just downstream of Stoken bridge T35N R26W S12 NE ¼	27 May 1995	1						Raven Stevens
0.1 mi above Blue Sky bridge	11 June 1995		1					Lynn Johnson (bird banded)
Kootenai River, 3/4 mi below dam	22 June 1995	1						Jean Habeck
Custer National Forest								
Rock Creek, Lake Fork, about 5 mi up at second bridge	5 June 1995					1		Babbit at confluence with
Black Canyon Creek	2-4 July 1995		1					via Lynn at Beartooth R.D.
near Lost Lake area	17 June 1995	1	2					Liz Sorenson via Beartooth RD.
near Broadwater Lake	18 June 1995	1						Rachel Jam via Beartooth R. D.
in Lost Lake	1 July 1995				1			Judy McNally
at Keyser Brown	1 July 1995		1					Susan Nichols
in Lost Lake	3 July 1995				1			Eddie Eckley
near Beartooth Pond	21 July 1995		1					Doug
confluence with Black Canyon Creek	2-4 July 1995		1					via Lynn at Beartooth R. D.
Rock Creek, West fork, below Sentinel Falls	30 June 1995				2			Roy Bulter
Deerlodge National Forest								
Rock Creek, Middle Fork	18 July 1995		1	1			1	K. Forkan & M. Fink
Flathead National Forest								
Flathead River, North Fork, T36N R21W S31 NE ¼	6 Aug 1995		1	3				Nancy Warren
Stillwater River, T34N R24W S30	4 May 1991	1	1					Lynn Johnson

Appendix E. Miscellaneous reports of Harlequin Ducks in Montana during 1995 and reports for prior years received during 1994.

Stream & Location	Date	Harlequins M	F	J	U	Pr	Br	Observer
Gallatin National Forest								
Boulder River, T6S R12E S21	1 May 1995					1		Jim Sparks
head of Hells Canyon	6 May 1995					1		Brad Stewart
T6S R12E S3	23 May 1995	1						Jim Sparks
T6S R12E S21	30 May 1995					3		Jim Sparks
lower fourmile Campgrounds	3 June 1995					1		Jim Sparks
lower fourmile Campgrounds	4 June 1995	3						Jim Sparks
confluence with Clear Creek (T6S R12E S16)	4 June 1995					1		Jim Sparks
confluence with Clear Creek (T6S R12E S16)	7 June 1995					1		Jim Sparks
confluence with Bridge Creek (T6S R12E S21)	7 June 1995					1		Jim Sparks
at Hillary Bridge (T6S R12E S4)	7 June 1995					1		Jim Sparks
above Hillary Bridge	11 June 1995					1		Jim Sparks
lower fourmile Campgrounds	11 June 1995	2						Jim Sparks
lower fourmile Campgrounds	24 June 1995		1					Jim Sparks
below Bridge Creek [T6S R12E S21]	18 July 1995		4	14(6,6,2)			3	Jim Sparks
below Bridge Creek [T6S R12E S21]	23 July 1995		3	15(6,6,2,1)			4	Jim Sparks
Hicks Park	25 July 1995		1	8			1	Jim Sparks
at confluence with Bridge Creek	27 July 1995		1	6			1	Jim Sparks
Clear Creek Park	14 Aug 1995		1	7			1	Jim Sparks
Hicks Park	25 Aug 1995		1	4			1	Jim Sparks
Boulder River, East Fork, above Box Canyon [T6S R12E S33]	11 June 1995	1						Jim Sparks
Lake Kathleer T7S R12E S11	30 June 1995	1						
Lewis and Clark National Forest								
Badger Creek, North, T29N R12W S22	14 May 1995	1	1					S. Tomson
T29N R12W S25	15 May 1995	1	1					S. Tomson
T29N R12W S25	14 May 1995	1	1					Maples
T29N R12W S33	14 May 1995	1	1					Maples
T28N R12W S4	14 May 1995	1	1					Maples
Birch Creek, Swift Reservoir	11 May 1995	1	1					Pat Finnegan
Swift Reservoir	11 May 1995	1	1					Pat Finnegan
Swift Reservoir	11 May 1995	4	3					Pat Finnegan
Birch Creek, South Fork, utm 5330500 358900	11 May 1995	1	1					Pat Finnegan
utm 5331400 358300	11 May 1995	1	1					Pat Finnegan

Appendix E. Miscellaneous reports of Harlequin Ducks in Montana during 1995 and reports for prior years received during 1994.

Stream & Location	Date	Harlequins M	F	J	U	Pr	Br	Observer
utm 5327700 359600	11 May 1995	2	2					Pat Finnegan
Sun River, South Fork T27N R10W S4	21 July 1995		3					Joe Woodhead
T21N R10W S19	30 May 1995	1	1					B. Flesch
confluence w/ North Fork	27 May 1995				1			Brad McBratney
confluence w/ North Fork	28 May 1995				1			Brad McBratney
T20N R10W S8	10 May 1995	1						Ray Mills
confluence w/ West Fork	13 June 1995		1					Mike Marsh
confluence w/ Burnt Creek	24 July 1995		1					Mike Marsh
100 m E of confluence w/ Deer Creek	18 July 1995		2	5			1	Mike Marsh
E of confluence w/ Deer Creek	25 July 1995		1	4			1	Mike Marsh
up S. Fork 2 mi toward Hoadly Creek	7 Aug 1995		1	5			1	Mike Marsh
1 mi W of Big Head Treail	9 Aug 1995		1	5			1	Mike Marsh
1 mi E of West Fork confluence	29 July 1995		1	4				Mike Marsh
Pretty Prairie Area	28 May 1995	8	3					Robert Willits
T22N R10W S27	27 May 1995	1						Bill Hill
T22N R10W S27	18 July 1995		1	2			1	Bill Hill
T22N R10W S26	14 June 1995	2	2					Bill Hill
Sun River, West Fork of South Fork T22N R12W S24	7 July 1995		2					R. Mills
Two Medicine, T30N R13W S28	12 May 1995	2						R. Fergus
Lolo National Forest								
Cache Creek, 5 mi up trail #317T	5 June 1995					1		William Deibert
Blackfoot River, North Fork, 1/8 mi upstream from Broadus Creek	25 May 1995					1		Dan Browder
Miscellaneous								
Marias River, Lat: 48 15' 30", Long: 110 51' 10"	2 Sept 1995				1			C. Paige
Boulder River, at Bernice Ponds, Jefferson Co.	25 June 1994	1						Sally Sovey
BRITISH COLUMBIA								
Flathead River, North Fork, about 5 mi N of U.S. border	13 July 1995		1					via Betty Kuropat
Wigwam River (first 10 mi. above border)	24 June 1994		6					John Gangemi

Appendix F.

Harlequin Duck numbers in each occurrence for Montana

Appendix F. Montana harlequin duck numbers in each occurrence.

Occurrence	Maximum # pairs/females seen on a single survey	Minimum # of pairs present in max. year[1]	Correction Factor	Estimated # of pairs present[2]	
Waterton River					14
includes Waterton River/Kootenai Lakes	8	8	.72	11	
Boundary Creek	-	1	.72	1	
Olson Creek	-	1	.72	1	
St. Mary River (above Lake)					8
includes St. Mary River	3	3	.72	4	
Reynolds Creek	1	2	.72	3	
Red Eagle Creek		1	.72	1	
Rose Creek and Otokomi Lake	0	0	.72	0	
Belly River		1	.72	1	1
Badger Creek					17
includes Badger Creek	3	3	.72	4	
North Badger Creek	6	6	.72	8	
South Badger Creek	3	3	.72	4	
Birch Creek					6
includes Birch Creek	0	0	.72	0	
North Fork Birch Creek	1	1	.72	1	
Middle Fork Birch Creek	1	1	.72	1	
South Fork Birch Creek	2	2	.72	3	
South Fork Two Medicine River					1
includes S. Fork Two Medicine River	1	1	.72	1	
Summit Creek	0	0	.72	0	
Two Medicine River					1
includes Two Medicine River	0	0	.72	0	
Paradise Creek	1	1	.72	1	

[1] The least number of pairs present in the year with the highest survey number, except when the occurrence is believed to be extirpated; then the number is 0.

[2] Total estimated pairs in multi-stream occurrences may not equal the sum of the streams because, while the numbers are shown as integers, the exact numbers are used in calculations.

Appendix F. Montana harlequin duck numbers in each occurrence.

Occurrence	Maximum # pairs/females seen on a single survey	Minimum # of pairs present in max. year[1]	Correction Factor	Estimated # of pairs present[2]	
North Fork Teton River	1	1	.72	1	1
Sun River					24
includes Sun River	0	0	.72	0	
North Fork Sun River	2	2	.72	3	
Moose Creek	1	1	.72	1	
South Fork Sun River	6	6	.72	8	
Straight Creek	2	2	.72	3	
West Fork Sun River	4	4	.72	6	
Ahorn Creek	1	1	.72	1	
Woods Creek	1	1	.72	1	
Boulder River	4	4	.72	6	6
Lake Fork Rock Creek	2	2	.72	3	3
Big Creek (Koocanusa)	0	0	.72	0	0
Callahan Creek					3
includes Callahan Creek	1	1	.72	1	
North Fork Callahan Creek	1	1	.72	1	
Grave Creek	5	5	.72	7	7
Kootenai Falls	0	0	.72	0	0
Quartz Creek	0	0	.72	0	0
Wigwam River	0	0	.72	0	0
West Fork Yaak River	1	1	.72	1	1
Middle Fork Rock Creek	0	1	.72	1	1
Big Creek (N.F. Flathead)	1	1	.72	1	1

[1] The least number of pairs present in the year with the highest survey number, except when the occurrence is believed to be extirpated; then the number is 0.

[2] Total estimated pairs in multi-stream occurrences may not equal the sum of the streams because, while the numbers are shown as integers, the exact numbers are used in calculations.

Appendix F. Montana harlequin duck numbers in each occurrence.

Occurrence	Maximum # pairs/females seen on a single survey	Minimum # of pairs present in max. year[1]	Correction Factor	Estimated # of pairs present[2]	
Upper North Fork Flathead River					8
Includes Kishenehn Creek	0	1	.72	1	
Trail Creek	6	6	.90	7	
McDonald Creek					41
includes McDonald Creek to Logan Ck	14	21	.90	23	
McDonald Ck above Logan Ck	3	3	.72	4	
Avalanche Creek	2	2	.72	3	
Mineral Creek	1	1	.72	1	
Snyder Creek	2	2	.72	3	
Sprague Creek	2	2	.72	3	
Fish Creek	2	2	.72	3	
Middle Fork Flathead R. (lower)	0	1	.72	1	
Middle Fork Flathead River					3
includes Bear Creek	0	1	.72	1	
Ole Creek	0	1	.72	1	
Upper South Fork Flathead River					14
includes Upper S. F. Flathead	4	4	.72	6	
White River	4	4	.72	6	
Little Salmon Creek	2	2	.72	3	
Spotted Bear River	3	3	.72	4	4
Sullivan Creek	2	2	.72	3	3
Wounded Buck Creek	1	1	.72	1	1
Swift Creek	1	1	.72	1	1

[1] The least number of pairs present in the year with the highest survey number, except when the occurrence is believed to be extirpated; then the number is 0.

[2] Total estimated pairs in multi-stream occurrences may not equal the sum of the streams because, while the numbers are shown as integers, the exact numbers are used in calculations.

Appendix F. Montana harlequin duck numbers in each occurrence.

Occurrence	Maximum # pairs/females seen on a single survey	Minimum # of pairs present in max. year[1]	Correction Factor	Estimated # of pairs present[2]	
North Fork Blackfoot River					8
includes North Fork Blackfoot	4	4	.72	6	
Dry Fork of N. F. Blackfoot	0	1	.72	1	
E. Fork North Fork Blackfoot	1	1	.72	1	
Rattlesnake Creek	0	0	.72	0	0
Trout Creek	2	0	.72	0	0
Elk Creek	0	1	.72	1	1
Noxon					17
includes Marten Creek	5	5	.90	6	
Rock Creek	3	4	.90	4	
Swamp Creek	3	3	.90	3	
Vermilion River	3	3	.90	3	
TOTAL		151			198

[1] The least number of pairs present in the year with the highest survey number, except when the occurrence is believed to be extirpated; then the number is 0.

[2] Total estimated pairs in multi-stream occurrences may not equal the sum of the streams because, while the numbers are shown as integers, the exact numbers are used in calculations.

Appendix G.

Streams surveyed for Harlequin Ducks in Montana during 1987-94

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
SASKATCHEWAN RIVER DRAINAGE: 100100												
South Saskatchewan River Drainage: 10010001												
Boundary Creek												
12	5431060	282040	12	5430890	287630	22	8	1993	walk		Ashley 1994b	
Olson Creek												
12	5425160	284870	12	5426260	287670	21	8	1993	walk		Ashley 1994b	
11	5425610	717970	11	5425690	718120	21	8	1993	walk		Ashley 1994b	
11	5424920	719390	12	5224800	280800	21	8	1993	walk		Ashley 1994b	
12	5425240	284140	12	5425160	284870	21	8	1993	walk		Ashley 1994b	
Waterton River (tributaties covered separately)												
12	5419870	287080	12	5426700	288300	20	8	1993	walk		Ashley 1994b	
12	5422730	286830	12	5423140	287500	20	8	1993	walk		Ashley 1994a	
12	5423140	287500	12	5426700	288300	22	9	1994	walk	2	Ashley 1994a	
St. Mary River Drainage: 10010002												
Red Eagle Creek												
12	5392160	315740	12	5397370	317760	19	8	1993	walk		Ashley 1994b	
12	5391230	315180	12	5392160	315740	19	8	1993	walk		Ashley 1994b	
Reynolds Creek												
12	5393540	305890	12	5393530	306490	30	6	1993	walk	1	Ashley 1994b	
12	5394810	303370	12	5393530	306490	13	8	1993	walk	9	Ashley 1994b	
12	5395640	302610	12	5393530	306490	26	5	1994	walk	2	Ashley 1994a	
12	5393540	305890	12	5393530	306490	4	9	1994	walk		Ashley 1994a	
St. Mary River (tributaties covered separately)												
12	5393530	306490	12	5393820	308290	30	6	1993	walk	1	Ashley 1994b	
12	5391740	303250	12	5393820	308290	13	8	1993	walk	1	Ashley 1994b	
12	5393530	306490	12	5393820	308290	4	9	1994	walk		Ashley 1994a	
MISSOURI RIVER HEADWATERS DRAINAGE: 100200												
Madison River Drainage: 10020007												
Beaver Creek												
12	4974580	471330	12	4977650	471600	21	6	1990			Markum 1990	
12	4974580	471330	12	4977650	471600	8	8	1990			Markum 1990	
Cabin Creek												
12	4970080	474230	12	4968280	472870	21	6	1990			Markum 1990	
12	4970080	474230	12	4968280	472870	8	8	1990			Markum 1990	
Grayling Creek												

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code
Stream

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
12	4960080	489580	12	4960250	491410	22	6	1990			Markum 1990	
12	4960080	489580	12	4960250	491410	9	8	1990			Markum 1990	
Madison River, West Fork												
12	4966850	472450	12	4967750	473400	8	8	1990			Markum 1990	
Gallatin River Drainage: 10020008												
Gallatin River (tributaries covered separately)												
12	5028060	482360	12	5033630	480750	23	5	1990			Markum 1990	
12	5013050	481190	12	5033630	480750	27	7	1990			Markum 1990	
12	5023330	486300	12	5013050	481190	30	7	1990			Markum 1990	
12	5012240	480320	12	5018000	485490	1	8	1990			Markum 1990	
12	4991280	484180	12	5012240	480320	1	8	1990			Markum 1990	
Hyalite Creek												
12	5039370	500180	12	5041240	499080	16	6	1990			Markum 1990	
12	5036870	501770	12	5039370	500180	19	6	1990			Markum 1990	
Squaw Creek												
12	5030680	487780	12	5031230	486810	23	5	1990			Markum 1990	
12	5030680	487780	12	5031720	482170	27	7	1990			Markum 1990	
Taylor Creek												
12	4989650	478730	12	4991080	484120	9	8	1990			Markum 1990	
UPPER MISSOURI RIVER DRAINAGE: 100301												
Dearborn/Missouri River Drainage: 10030102												
Dearborn River (tributaries covered separately)												
12	5234710	377850	12	5236430	385580	30	4	1991	walk		Diamond and Finnegan 1993	
12	5235380	383790	12	5236430	385580	13	5	1991	walk		Diamond and Finnegan 1993	
12	5234030	382000	12	5243190	369580	12	5	1992	walk		Diamond and Finnegan 1993	
Falls Creek												
12	5231550	387880	12	5236750	387850	13	5	1991	walk		Diamond and Finnegan 1993	
12	5231550	387880	12	5236750	387850	3	8	1991	walk		Diamond and Finnegan 1993	
Sun River Drainage: 10030104												
Biggs Creek												
12	5292020	363650	12	5288440	357150	17	7	1990	walk		Diamond and Finnegan 1993	
Gibson Reservoir												
12	5273300	367540	12	5276650	360730	14	7	1990			Diamond and Finnegan 1993	
12	5276620	360550	12	5273650	366980	6	4	1991			Diamond and Finnegan 1993	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code / Stream	Upper UTM		Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
12	5276620	360550	12	5273650	366980	16	4	1991			Diamond and Finnegan 1993	
12	5276620	360550	12	5273650	366980	23	4	1991			Diamond and Finnegan 1993	
12	5276620	360550	12	5273650	366980	25	4	1991			Diamond and Finnegan 1993	
12	5276620	360550	12	5273650	366980	6	5	1991			Diamond and Finnegan 1993	
12	5276620	360550	12	5273650	366980	15	5	1991			Diamond and Finnegan 1993	
12	5276620	360550	12	5273650	366980	3	6	1991			Diamond and Finnegan 1993	
12	5276620	360550	12	5273650	366980	17	7	1991			Diamond and Finnegan 1993	
12	5276620	360550	12	5273650	366980	23	7	1991			Diamond and Finnegan 1993	
Moose Creek												
12	5285350	349190	12	5287040	357200	15	7	1990	walk		Diamond and Finnegan 1993	
12	5286190	352910	12	5287040	357200	2	6	1992	walk		Diamond and Finnegan 1993	
12	5287250	355190	12	5287040	357200	5	6	1991	walk		Diamond and Finnegan 1993	
12	5281490	339850	12	5287040	357200	17	7	1991	walk	1	Diamond and Finnegan 1993	
12	5286190	352910	12	5287250	355190	9	8	1991	walk		Diamond and Finnegan 1993	
12	5281490	339850	12	5287040	357200	16	8	1991	walk		Diamond and Finnegan 1993	
Rock Creek												
12	5291080	351990	12	5292130	354580	5	6	1991	walk		Diamond and Finnegan 1993	
12	5292130	354580	12	5290940	355740	17	7	1991	walk		Diamond and Finnegan 1993	
Smith Creek												
12	5246950	372430	12	5248530	373270	14	5	1991	walk			
Sun River, North Fork (tributaries covered separately)												
12	5285460	357370	12	5276620	360550	15	7	1990	walk		Diamond and Finnegan 1993	
12	5293650	356310	12	5285460	357370	16	7	1990	walk		Diamond and Finnegan 1993	
12	5303420	354870	12	5293650	356310	17	7	1990	walk		Diamond and Finnegan 1993	
12	5288420	357150	12	5276620	360550	8	4	1991	walk		Diamond and Finnegan 1993	
12	5277690	360400	12	5276620	360550	16	4	1991	walk		Diamond and Finnegan 1993	
12	5285460	357370	12	5276620	360550	23	4	1991	walk	1	Diamond and Finnegan 1993	
12	5285460	357370	12	5276620	360550	13	4	1992	walk		Diamond and Finnegan 1993	
12	5285460	357370	12	5276620	360550	16	4	1992	walk		Diamond and Finnegan 1993	
12	5285460	357370	12	5276620	360550	12	5	1992	walk		Diamond and Finnegan 1993	
12	5285460	357370	12	5276620	360550	13	5	1992	walk	1	Diamond and Finnegan 1993	
12	5285460	357370	12	5276620	360550	19	7	1992	walk		Diamond and Finnegan 1993	
12	5285460	357370	12	5280070	358970	25	7	1992	walk		Diamond and Finnegan 1993	
12	5282580	357310	12	5276620	360550	1	6	1992	walk	5	Diamond and Finnegan 1993	
12	5303350	354890	12	5293680	356120	13	5	1992	walk		Diamond and Finnegan 1993	13-14 May 1992
12	5287680	357500	12	5285460	357370	24	4	1991	walk	2	Diamond and Finnegan 1993	
12	5285460	357370	12	5276620	360550	3	6	1991	walk		Diamond and Finnegan 1993	
12	5293680	356120	12	5285460	357370	4	6	1991	walk	1	Diamond and Finnegan 1993	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
12	5293680	356120	12	5285460	357370	14	4	1992	walk		Diamond and Finnegan 1993	
12	5293680	356120	12	5285460	357370	28	4	1992	walk		Diamond and Finnegan 1993	
12	5293680	356120	12	5285460	357370	2	6	1992	walk		Diamond and Finnegan 1993	
12	5293680	356120	12	5285460	357370	26	7	1992	walk		Diamond and Finnegan 1993	
12	5285460	357370	12	5282610	357240	15	4	1992	walk		Diamond and Finnegan 1993	
12	5300430	356430	12	5293680	356120	5	6	1991	walk	3	Diamond and Finnegan 1993	
12	5286070	358970	12	5276620	360550	17	7	1991	walk		Diamond and Finnegan 1993	
12	5302520	355670	12	5293680	356120	18	7	1991	walk	1	Diamond and Finnegan 1993	
12	5302520	355670	12	5293680	356120	3	6	1992	walk		Diamond and Finnegan 1993	
12	5285460	357370	12	5276620	360550	7	8	1991	walk		Diamond and Finnegan 1993	
12	5292660	356330	12	5285460	357370	8	8	1991	walk		Diamond and Finnegan 1993	
12	5302520	355670	12	5293680	356120	10	8	1991	walk	5	Diamond and Finnegan 1993	
12	5293680	356120	12	5287040	357200	17	8	1991	walk		Diamond and Finnegan 1993	
12	5302520	355670	12	5293680	356120	18	8	1991	walk		Diamond and Finnegan 1993	
Sun River, South Fork (tributaries covered separately)												
12	5270400	356100	12	5275690	358790	27	4	1990	walk	1	Diamond and Finnegan 1993	
12	5262040	357280	12	5268030	355770	8	6	1990	walk	8	Diamond and Finnegan 1993	
12	5270400	356100	12	5263380	357500	16	7	1990	walk	10	Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	3	4	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5259940	354770	3	4	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5259940	354770	8	5	1992	walk	9	Diamond and Finnegan 1993	
12	5262040	357280	12	5259940	354770	27	5	1992	walk	4	Diamond and Finnegan 1993	
12	5270400	356100	12	5275690	358790	4	4	1991	walk		Diamond and Finnegan 1993	
12	5270400	356100	12	5275690	358790	16	4	1992	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5265030	356790	10	4	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	17	4	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	7	5	1992	walk	3	Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	28	5	1992	walk	15	Diamond and Finnegan 1993	
12	5262040	357280	12	5251880	357630	12	5	1992	walk	2	Diamond and Finnegan 1993	
12	5259940	354770	12	5265030	356790	12	5	1992	walk	6	Diamond and Finnegan 1993	
12	5270400	356100	12	5276620	360550	19	4	1991	walk		Diamond and Finnegan 1993	
12	5270400	356100	12	5276620	360550	6	5	1992	walk	1	Diamond and Finnegan 1993	
12	5270400	356100	12	5276620	360550	29	5	1992	walk		Diamond and Finnegan 1993	
12	5259190	354770	12	5262040	357280	25	5	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5268850	355450	26	4	1991	walk	5	Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	7	5	1991	walk	4	Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	13	4	1992	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	17	7	1992	walk		Diamond and Finnegan 1993	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
12	5262040	357280	12	5270400	356100	24	7	1992	walk	13	Diamond and Finnegan 1993	
12	5270400	356100	12	5276620	360550	8	5	1991	walk	10	Diamond and Finnegan 1993	
12	5270400	356100	12	5276620	360550	18	7	1992	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	15	5	1991	walk	1	Diamond and Finnegan 1993	
12	5270400	356100	12	5276620	360550	18	5	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	28	5	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5259940	354770	29	5	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5251400	357690	16	7	1992	walk	6	Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	14	6	1991	walk	2	Diamond and Finnegan 1993	
12	5268850	355450	12	5262040	357280	12	7	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5268850	355450	16	7	1991	walk		Diamond and Finnegan 1993	
12	5273700	358500	12	5276620	360550	2	8	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	2	8	1991	walk		Diamond and Finnegan 1993	
12	5270400	356100	12	5273700	358500	3	8	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5270400	356100	7	8	1991	walk		Diamond and Finnegan 1993	
12	5262040	357280	12	5268850	355450	13	8	1991	walk		Diamond and Finnegan 1993	
Sun River, West Fork												
12	5271020	345230	12	5268880	355470	17	7	1990	walk		Diamond and Finnegan 1993	
12	5271020	345230	12	5268880	355470	9	5	1991	walk		Diamond and Finnegan 1993	
12	5271020	345230	12	5268880	355470	16	5	1991	walk	6	Diamond and Finnegan 1993	
12	5271020	345230	12	5268880	355470	15	7	1991	walk		Diamond and Finnegan 1993	
12	5271020	345230	12	5268880	355470	5	8	1991	walk		Diamond and Finnegan 1993	
12	5276180	344330	12	5271020	345230	6	8	1991	walk		Diamond and Finnegan 1993	
12	5276180	344330	12	5268330	353830	29	5	1992	walk		Diamond and Finnegan 1993	
12	5276180	344330	12	5268640	344480	18	7	1992	walk		Diamond and Finnegan 1993	
12	5269050	347360	12	5268880	355470	5	5	1992	walk	2	Diamond and Finnegan 1993	
12	5269050	347360	12	5268880	355470	28	5	1992	walk	4	Diamond and Finnegan 1993	
12	5276180	344330	12	5268880	355470	14	8	1991	walk		Diamond and Finnegan 1993	
12	5276180	344330	12	5268880	355470	18	7	1992	walk	2	Diamond and Finnegan 1993	
12	5279630	342980	12	5276180	344330	15	8	1991	walk		Diamond and Finnegan 1993	
12	5279630	342980	12	5269050	347360	6	5	1992	walk	9	Diamond and Finnegan 1993	
Ahorn Creek												
12	5267780	344670	12	5268640	344480	6	8	1991	walk		Diamond and Finnegan 1993	
12	5265550	344550	12	5268640	344480	14	8	1991	walk		Diamond and Finnegan 1993	
12	5265790	344540	12	5268640	344480	27	5	1992	walk	1	Diamond and Finnegan 1993	
Straight Creek												
12	5260860	357180	12	5254750	359650	9	6	1990	walk		Diamond and Finnegan 1993	
12	5251580	360500	12	5260860	357780	3	4	1991	walk		Diamond and Finnegan 1993	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
12	5251580	360500	12	5260860	357780	30	4	1991	walk		Diamond and Finnegan 1993	
12	5251580	360500	12	5260860	357780	30	5	1991	walk		Diamond and Finnegan 1993	
12	5251580	360500	12	5260860	357780	13	5	1992	walk	4	Diamond and Finnegan 1993	
12	5251580	360500	12	5260860	357780	26	5	1992	walk	2	Diamond and Finnegan 1993	
12	5253010	360670	12	5260860	357780	14	4	1992	walk		Diamond and Finnegan 1993	
12	5253010	360670	12	5260860	357780	16	6	1992	walk		Diamond and Finnegan 1993	
12	5259490	359280	12	5260860	357780	8	5	1992	walk		Diamond and Finnegan 1993	
12	5248200	362690	12	5260860	357780	13	7	1991	walk		Diamond and Finnegan 1993	
12	5256400	359180	12	5260860	357780	5	8	1991	walk		Diamond and Finnegan 1993	

MARIAS RIVER DRAINAGE: 100302

South Marias River Headwaters Drainage: 10030201

Badger Creek

12	5347880	348810	12	5350900	350100	29	6	1990	walk	4	Diamond and Finnegan 1993	
12	5345220	344440	12	5347880	348810	3	5	1991	walk		Diamond and Finnegan 1993	
12	5345220	344440	12	5347880	348810	29	4	1992	walk		Diamond and Finnegan 1993	
12	5345220	344440	12	5347880	348810	9	7	1992	walk	3	Diamond and Finnegan 1993	
12	5345220	344440	12	5345160	345810	3	7	1991	walk	9	Diamond and Finnegan 1993	
12	5345220	344440	12	5345810	347110	30	7	1991	walk		Diamond and Finnegan 1993	

Badger Creek, North — 2

12	5347500	342390	12	5345220	344440	8	8	1990	walk		Diamond and Finnegan 1993	
12	5347500	342390	12	5345220	344440	28	8	1990	walk		Diamond and Finnegan 1993	
12	5341970	338630	12	5346540	341230	2	5	1991	walk	4	Diamond and Finnegan 1993	
12	5341970	338630	12	5346540	341230	19	5	1992	walk	4	Diamond and Finnegan 1993	
12	5346540	341230	12	5345220	344440	3	5	1991	walk		Diamond and Finnegan 1993	
12	5341970	338630	12	5345220	344440	21	5	1991	walk	5	Diamond and Finnegan 1993	
12	5341970	338630	12	5345220	344440	3	7	1991	walk		Diamond and Finnegan 1993	
12	5345960	340900	12	5345220	344440	30	4	1992	walk	2	Diamond and Finnegan 1993	
12	5345960	340900	12	5345220	344440	20	5	1992	walk	1	Diamond and Finnegan 1993	
12	5340040	336830	12	5345220	344440	8	7	1992	walk	19	Diamond and Finnegan 1993	8-9 July 1992
12	5341970	338630	12	5345960	340900	29	4	1992	walk	3	Diamond and Finnegan 1993	

Badger Creek, South

12	5340880	343550	12	5345220	344400	9	8	1990	walk		Diamond and Finnegan 1993	
12	5335050	347150	12	5345220	344400	19	5	1992	walk	7	Diamond and Finnegan 1993	
12	5333790	348010	12	5345220	344400	26	8	1990	walk		Diamond and Finnegan 1993	26-27 Aug 1990
12	5338690	344130	12	5342980	344260	9	7	1992	walk	9	Diamond and Finnegan 1993	
12	5343340	344250	12	5345220	344400	3	7	1991	walk		Diamond and Finnegan 1993	
12	5343340	344250	12	5345220	344400	9	7	1992	walk	2	Diamond and Finnegan 1993	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code / Stream	Upper UTM		Lower UTM							#		
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
	12	5338770	343340	12	5345220	344400	31	7	1991	walk		Diamond and Finnegan 1993	
Birch Creek													
Birch Creek, Middle Fork													
	12	5327750	354240	12	5331130	358340	25	8	1990	walk		Diamond and Finnegan 1993	
	12	5330070	356880	12	5331130	358340	23	4	1991	walk		Diamond and Finnegan 1993	
	12	5330070	356880	12	5331130	358340	5	7	1991	walk		Diamond and Finnegan 1993	
	12	5330070	356880	12	5331130	358340	11	5	1992	walk	3	Diamond and Finnegan 1993	
	12	5329300	354200	12	5331130	358340	28	7	1991	walk		Diamond and Finnegan 1993	
	12	5329300	354200	12	5331130	358340	23	4	1992	walk		Diamond and Finnegan 1993	
	12	5329730	355920	12	5331130	358340	15	5	1992	walk	3	Diamond and Finnegan 1993	
Birch Creek, North Fork													
	12	5335210	353980	12	5335540	358700	6	7	1990	walk		Diamond and Finnegan 1993	
	12	5333500	350140	12	5335210	353980	26	8	1990	walk		Diamond and Finnegan 1993	
	12	5336110	356250	12	5335540	358700	8	4	1991	walk		Diamond and Finnegan 1993	
	12	5335700	355300	12	5335540	358700	23	4	1991	walk		Diamond and Finnegan 1993	
	12	5335700	355300	12	5335540	358700	30	4	1991	walk	2	Diamond and Finnegan 1993	
	12	5335110	351530	12	5335540	358700	5	7	1991	walk		Diamond and Finnegan 1993	
	12	5333500	350140	12	5335540	358700	9	7	1991	walk		Diamond and Finnegan 1993	
	12	5335080	352900	12	5335540	358700	23	7	1991	walk	1	Diamond and Finnegan 1993	
	12	5335210	353980	12	5335540	358700	23	4	1992	walk		Diamond and Finnegan 1993	
	12	5335110	351530	12	5335540	358700	5	8	1992	walk		Diamond and Finnegan 1993	
Birch Creek, South Fork													
	12	5331130	358340	12	5333310	359240	6	7	1990	walk		Diamond and Finnegan 1993	
	12	5324080	357450	12	5331130	358340	24	8	1990	walk	5	Diamond and Finnegan 1993	
	12	5329890	359320	12	5333310	359240	23	4	1991	walk		Diamond and Finnegan 1993	
	12	5329890	359320	12	5333310	359240	5	7	1991	walk		Diamond and Finnegan 1993	
	12	5324690	358010	12	5333310	359240	29	7	1991	walk		Diamond and Finnegan 1993	
	12	5327190	359650	12	5333310	359240	14	5	1992	walk	3	Diamond and Finnegan 1993	
	12	5328710	359870	12	5333310	359240	6	8	1992	walk	5	Diamond and Finnegan 1993	
Paradise Creek													
	12	5370590	323400	12	5372240	324280	18	5	1993	walk	4	Ashley 1994b	
Aster Creek													
	12	5370330	324430	12	5371860	323480	18	5	1993	walk		Ashley 1994b	
Two Medicine River (tributaries covered separately)													
	12	5371630	322050	12	5370880	319240	19	5	1993	walk	2	Ashley 1994b	
	12	5373400	325250	12	5373140	325190	19	5	1993	walk		Ashley 1994b	
Two Medicine River, South Fork													
	12	5355390	329280	12	5350890	334090	22	6	1990	walk		Diamond and Finnegan 1993	

Drainage: Hydologic Code

Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
12	5355390	329280	12	5358650	333930	25	6	1990	walk		Diamond and Finnegan 1993	
12	5351420	336830	12	5355390	329280	30	8	1990	walk		Diamond and Finnegan 1993	
12	5355390	329280	12	5358390	331500	24	4	1991	walk		Diamond and Finnegan 1993	
12	5351740	332720	12	5355390	329280	1	5	1991	walk		Diamond and Finnegan 1993	
12	5351420	336830	12	5352050	332060	2	5	1991	walk		Diamond and Finnegan 1993	
12	5351420	336830	12	5352050	332060	22	5	1991	walk		Diamond and Finnegan 1993	
12	5351420	336830	12	5352050	332060	4	8	1991	walk		Diamond and Finnegan 1993	
12	5351420	336830	12	5355390	329280	31	7	1991	walk		Diamond and Finnegan 1993	
12	5354730	329280	12	5359190	337240	22	4	1992	walk		Diamond and Finnegan 1993	
12	5351420	336830	12	5355390	329280	28	4	1992	walk		Diamond and Finnegan 1993	
12	5351420	336830	12	5358390	331500	1	5	1992	walk		Diamond and Finnegan 1993	
12	5351420	336830	12	5355390	329280	18	5	1992	walk		Diamond and Finnegan 1993	
12	5354730	329280	12	5358390	331500	21	5	1992	walk	2	Diamond and Finnegan 1993	
12	5351420	336830	12	5355390	329280	8	7	1992	walk		Diamond and Finnegan 1993	
Teton River Drainage: 10030205												
Deep Creek												
Deep Creek, North Fork												
12	5288580	377180	12	5291000	373330	20	5	1992	walk		Diamond and Finnegan 1993	
Deep Creek, South Fork												
12	5287280	376260	12	5287870	373230	19	5	1992	walk		Diamond and Finnegan 1993	
Teton River, North Fork												
12	5312950	365140	12	5309310	367900	28	7	1991	walk	1	Diamond and Finnegan 1993	
12	5312950	365140	12	5309310	367900	7	5	1992	walk	1	Diamond and Finnegan 1993	
12	5312950	365140	12	5309310	367900	4	8	1992	walk		Diamond and Finnegan 1993	
12	5311090	366680	12	5308170	369800	21	4	1992	walk		Diamond and Finnegan 1993	
12	5311770	365850	12	5309310	367900	6	6	1992	walk		Diamond and Finnegan 1993	
Teton River, South Fork												
12	5303120	373220	12	5303690	377500	31	7	1991	walk		Diamond and Finnegan 1993	
12	5303120	373220	12	5303690	377500	21	4	1992	walk		Diamond and Finnegan 1993	
12	5303120	373220	12	5303690	377500	4	8	1992	walk		Diamond and Finnegan 1993	
Teton River, West Fork												
12	5312900	365140	12	5312420	361840	3	5	1992	walk		Diamond and Finnegan 1993	
UPPER YELLOWSTONE RIVER DRAINAGE: 100700												
Upper Yellowstone River Drainage: 10070002												
Big Creek												
12	5016670	510440	12	5011510	496250	20	8	1991	walk		Johnson 1991	20-21 Aug 1991

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
Bridge Creek												
12	5013680	557530	12	5015100	559510	2	7	1991	walk		Johnson 1991	
Boulder River (tributaries covered separately)												
12	5016130	559580	12	5044000	562000	19	5	1990	walk	2	Markum 1990	
12	5031610	563350	12	5037640	560880	6	6	1990	walk		Markum 1990	
12	5016130	559580	12	5021090	560390	6	6	1990	walk	8	Markum 1990	
12	5016130	559580	12	5021090	560390	16	6	1990	walk		Markum 1990	
12	5031610	563350	12	5037640	560880	7	8	1990	walk		Markum 1990	
12	5021090	560390	12	5023330	562000	13	8	1990	walk		Markum 1990	
12	5016130	559580	12	5031610	563350	23	5	1990	walk	8	Markum 1990	
12	5037640	560880	12	5044000	562000	19	6	1991	walk		Johnson 1991	
12	5021090	560390	12	5037640	560880	20	6	1991	walk	2	Johnson 1991	20-23 June 1991
12	5016130	559580	12	5021090	560390	29	6	1991	walk	1	Johnson 1991	
12	5004350	560050	12	5006430	559320	4	7	1991	walk		Johnson 1991	
12	5008520	557970	12	5013900	559380	5	7	1991	walk		Johnson 1991	
						6	5	1992		3	Jim Sparks, pers. comm.	various point locations
						4	6	1992		2	Jim Sparks, pers. comm.	various point locations
12	5021090	560390	12	5029870	563530	12	6	1993		5	Reichel and Genter 1994	
12	5013900	559380	12	5021090	560390	13	6	1993		1	Reichel and Genter 1994	
12	5013900	559380	12	5057570	570060	14	6	1993			Reichel and Genter 1994	
12	5013900	559380	12	5031610	563350	22	7	1993		2	Reichel and Genter 1994	
12	5038840	571690	12	5013900	559380	2	5	1994	walk		Jim Sparks, pers. comm.	
Boulder River, East												
12	5042510	566710	12	5043960	566650	19	5	1990	walk		Markum 1990	
12	5037500	571670	12	5040050	571320	19	5	1990	walk		Markum 1990	
12	5037500	571670	12	5041250	568240	25	7	1990	walk		Markum 1990	
12	5041250	568240	12	5043960	566650	13	8	1990	walk		Markum 1990	
12	5043960	566650	12	5052350	568120	1	7	1991	walk	1	Johnson 1991	1-2 July 1991
12	5005030	564390	12	5009370	563630	3	7	1991	walk		Johnson 1991	
Rainbow Creek												
12	5009110	566860	12	5009370	563630	3	7	1991	walk		Johnson 1991	
Boulder River, South Fork												
12	5009950	558140	12	5007440	558350	4	7	1991	walk		Johnson 1991	
Sheep Creek												
12	5007480	558340	12	5006390	558450	4	7	1991	walk		Johnson 1991	
Boulder River, West Fork												
12	5036050	549720	12	5043860	553990	28	5	1990	walk		Markum 1990	
12	5034730	549990	12	5042590	553310	2	8	1990	walk		Markum 1990	

Drainage: Hydologic Code
Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
Elk Creek												
12	5047550	570190	12	5048230	569440	5	7	1991	walk		Johnson 1991	
Lambert Creek												
12	5007890	546300	12	5011110	545760	17	8	1991	walk		Johnson 1991	
Mill Creek (tributaries covered separately)												
12	5012680	540520	12	5013290	539190	21	5	1990	walk		Markum 1990	
12	5014810	537310	12	5013290	539190	14	8	1990	walk		Markum 1990	
12	5012000	545520	12	5017980	534110	18	8	1991	walk		Johnson 1991	18-19 Aug 1991
Mill Creek, East Fork												
12	5021230	548420	12	5017980	534110	16	8	1991	walk		Johnson 1991	16-17 Aug 1991
Mill Creek, West Fork												
12	5006020	533480	12	5016200	534570	22	8	1991	walk		Johnson 1991	22-23 Aug 1991
Passage Creek												
12	5008680	539230	12	5013290	539170	17	8	1991	walk		Johnson 1991	
Sixmile Creek												
12	5002750	526360	12	5011040	517940	24	8	1991	walk		Johnson 1991	24-25 Aug 1991
Sixmile Creek, North Fork												
12	5004390	528040	12	5008890	520180	24	8	1991	walk		Johnson 1991	
Speculator Creek												
12	5026740	558810	12	5026190	562590	22	6	1991	walk		Johnson 1991	22-23 June 1991
Upsidedown Creek												
12	5013610	563050	12	5014910	559570	30	6	1991	walk		Johnson 1991	
West Boulder River												
12	5032840	547700	12	5043870	553990	25	6	1991	walk		Johnson 1991	
12	5043870	553990	12	5056570	570060	14	6	1993	boat		Reichel and Genter 1994	
Stillwater River Drainage: 10070005												
Castle Creek												
12	5033850	584100	12	5033950	590180	8	8	1991	walk		Johnson 1991	
Cathedral Creek												
12	5027670	581560	12	5026340	581650	14	8	1991	walk		Johnson 1991	
Clarks Creek												
12	5001550	581240	12	5001920	578890	30	7	1991	walk		Johnson 1991	
Divide Creek												
12	5024680	570560	12	5023770	570690	13	8	1991	walk		Johnson 1991	
Falls Creek												
12	5014600	586440	12	5017860	583570	3	8	1991	walk		Johnson 1991	
Flood Creek												

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream	Upper UTM		Lower UTM							#		
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
Glacier Creek	12	5016240	578270	12	5017500	583550	2	8	1991	walk		Johnson 1991	
Horseshoe Creek	12	4999700	580290	12	5001020	579140	30	7	1991	walk		Johnson 1991	
Initial Creek	12	5018200	576650	12	5001650	578860	30	7	1991	walk		Johnson 1991	
Iron Creek	12	5027640	582590	12	5028390	581920	14	8	1991	walk		Johnson 1991	
Lightning Creek	12	5028840	577050	12	5028450	581950	14	8	1991	walk		Johnson 1991	
Pin Creek	12	5023000	573780	12	5024480	574290	13	8	1991	walk		Johnson 1991	
Rosebud Creek, West	12	5033850	584100	12	5033950	590180	9	8	1991	walk		Johnson 1991	
	12	5010580	599630	12	5014140	606030	14	6	1990	walk		Markum 1990	
	12	5007180	590090	12	5015890	608130	8	7	1991	walk		Johnson 1991	
Huckleberry Creek	12	5008070	594240	12	5007080	593940	8	7	1991	walk		Johnson 1991	
Stillwater River (tributaries covered separately)	12	5022630	586340	12	5026130	588390	12	6	1990	walk		Markum 1990	
	12	5012910	582110	12	5022630	586340	13	6	1990	walk		Markum 1990	
	12	5016070	583360	12	5022630	586340	29	8	1990	walk		Markum 1990	
	12	5009210	580060	12	5016070	583360	29	8	1990	walk		Markum 1990	
	12	5007650	579640	12	5022290	586050	31	7	1991	walk		Johnson 1991	31 July - 2 Aug 1991
	12	5022630	586340	12	5032040	594500	23	7	1993			Reichel and Genter 1994	
Stillwater River, West Fork (tributaries covered separately)	12	5028390	581920	12	5032030	587300	10	8	1991	walk		Johnson 1991	
	12	5017880	570680	12	5023770	507690	12	8	1991	walk		Johnson 1991	
	12	5023770	507690	12	5027440	580870	13	8	1991	walk		Johnson 1991	13-14 Aug 1991
Storm Creek	12	5009230	585380	12	5012910	582110	3	8	1991	walk		Johnson 1991	
Trail Creek	12	5022900	569170	12	5022900	569960	13	8	1991	walk		Johnson 1991	
Tumbel Creek	12	5022790	575940	12	5024550	575950	13	8	1991	walk		Johnson 1991	

Clark's Fork of the Yellowstone River Drainage: 10070006

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
KOOTENAI RIVER DRAINAGE: 170101												
Upper Kootenai River Drainage: 17010101												
Big Creek												
11	5401680	615280	11	5400280	621700	19	5	1989			Fairman, Genter, and Miller 1989	
11	5393130	609390	11	5400280	621700	24	8	1989			Kerr 1989 data forms	23-25 August 1989
11	5393130	609390	11	5400280	621700	13	6	1990			Fairman, Genter, and Miller 1990	
11	5397990	611730	11	5400500	621140	31	8	1990		1	Fairman, Genter, and Miller 1990	
11	5397990	611730	11	5400500	621140	10	7	1991			Merz 1991	
11	5397990	611730	11	5400500	621140	30	5	1993			Reichel and Genter 1994	
11	5394360	610400	11	5400280	621700	7	5	1994			Reichel and Genter 1995	
Callahan Creek												
11	5365000	574750	11	5364950	577530	11	6	1989	walk		Fairman, Genter, and Miller 1990	
11	5365000	574750	11	5364950	577530	23	7	1989	walk		Kerr 1989 data forms	
						8	5	1990	walk		Fairman, Genter, and Miller 199	numerous spot checks
11	5364900	573100	11	5367420	582050	24	7	1990	walk		Fairman, Genter, and Miller 1990	
11	5364900	573100	11	5364950	577530	9	9	1991	walk		Merz 1991	
11	5364900	573100	11	5364950	577530	28	5	1993			Reichel and Genter 1994	
North Fork Callahan Creek												
11	5364900	573100	11	5366920	567100	23	5	1990	walk	3	Fairman, Genter, and Miller 1990	
11	5364900	573100	11	5366920	567100	23	7	1990	walk	4	Fairman, Genter, and Miller 1990	
11	5365000	571700	11	5366920	567100	4	8	1990	walk	2	Fairman, Genter, and Miller 1990	
11	5365280	570420	11	5366920	567100	4	8	1991	walk		Merz 1991	
11	5364900	573100	11	5366920	567100	28	5	1993			Reichel and Genter 1994	
South Fork Callahan Creek												
11	5360560	567500	11	5366920	567100	27	7	1990	walk		Fairman, Genter, and Miller 1990	
11	5362500	570700	11	5366920	567100	9	7	1991	walk		Merz 1991	
11	5360560	567500	11	5366920	567100	28	5	1993	walk		Reichel and Genter 1994	
Cedar Creek												
11	5362230	597210	11	5364020	600930	16	6	1990	walk		Fairman and Miller 1990	
Cherry Creek												
11	5344000	607430	11	5347030	609190	11	8	1990	walk		Fairman and Miller 1990	
11	5351060	608980	11	5352790	608870	15	8	1990	walk		Fairman and Miller 1990	
Granite Creek												
11	5350600	604460	11	5351190	606080	24	6	1990	walk		Fairman and Miller 1990	
11	5349750	601350	11	5351650	608650	14	8	1990	walk		Fairman and Miller 1990	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
Grave Creek												
11	5421800	664760	11	5417230	661340	19	5	1989		2	Kerr 1989	
11	5421800	664760	11	5418170	663220	1	6	1989		4	Kerr 1989	
						15	6	1989			Fairman, Genter, and Miller 198	Survey section unknown
						21	6	1989			Fairman, Genter, and Miller 198	Survey section unknown
						19	7	1989		1	Fairman, Genter, and Miller 198	19-20 July 1989, Survey
11	5421800	664760	11	5419620	663520	19	7	1989		1	Kerr 1989	
11	5421800	664760	11	5413920	659800	17	6	1990		2	Fairman, Genter, and Miller 199	17-18 June 1990
11	5411270	658700	11	5409200	655030	2	8	1990			Fairman, Genter, and Miller 1990	
11	5421800	664760	11	5418170	663220	2	8	1990			Fairman, Genter, and Miller 1990	
11	5411270	658700	11	5409200	655030	10	5	1993			Reichel and Genter 1994	
11	5421800	664760	11	5410500	660730	8	5	1994		6	Reichel and Genter 1995	
11	5417230	661340	11	5409200	655030	31	7	1994		5	Reichel and Genter 1995	
11	5421800	664760	11	5418170	663220	1	8	1994		3	Reichel and Genter 1995	
Keeler Creek												
11	5356380	584620	11	5356700	585100	24	5	1989			Fairman, Genter, and Miller 1989	
11	5354000	577350	11	5356380	584620	21	6	1990			Fairman, Genter, and Miller 199	21-22 June 1990
11	5353400	573900	11	5356380	584620	30	7	1990			Fairman, Genter, and Miller 199	30-31 July 1990
Kootenai River (tributaries covered separately)												
11	5365700	600790	11	5367310	592040	25	7	1989			Kerr 1989	25 July and 20 Aug 1989
11	5359730	615170	11	5361260	607560	8	5	1990			Fairman and Miller 1990	
11	5362600	624600	11	5366680	594240	17	5	1990			Fairman and Miller 1990	
11	5378900	575520	11	5366700	593900	3	8	1990			Fairman and Miller 1990	
11	5367440	591670	11	5366760	596490	12	8	1990			Fairman and Miller 1990	
11	5359730	615170	11	5361260	607560	17	8	1990			Fairman and Miller 1990	
Kootenai Falls area												
11	5367400	591600	11	5367200	590900	14	5	1989		3	Kerr 1989	
11	5367200	592300	11	5367200	590900	25	5	1989			Fairman, Genter, and Miller 1989	
11	5367200	592300	11	5367200	590900	28	5	1989		6	Kerr 1989	
11	5367400	591600	11	5367200	590900	4	6	1989			Fairman, Genter, and Miller 1989	
11	5367400	591600	11	5367200	590900	11	6	1989		1	Kerr 1989	
11	5367400	591600	11	5367200	590900	24	6	1989			Fairman, Genter, and Miller 1989	
11	5367200	592300	11	5367200	590900	8	5	1990			Fairman, Genter, and Miller 1990	
11	5367200	592300	11	5367200	590900	17	5	1990		1	Fairman, Genter, and Miller 1990	
11	5367400	591600	11	5367200	590900	20	5	1990		1	Fairman, Genter, and Miller 1990	
11	5367400	591600	11	5367200	590900	30	6	1990			Fairman, Genter, and Miller 1990	
11	5367200	592300	11	5367200	590900	21	7	1990			Fairman, Genter, and Miller 1990	
11	5367200	592300	11	5367200	590900	19	8	1990			Fairman, Genter, and Miller 1990	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
Lake Ceek												
						24	5	1989			Fairman, Genter, and Miller 198	Exact survey section unk
Libby Creek												
11	5330200	608100	11	5333680	609670	13	8	1990			Fairman, Genter, and Miller 1990	
Pinkham Creek												
11			11			26	5	1990	walk		Fairman, Genter, and Miller 1989	
11	5410380	637190	11	5410070	630080	12	6	1990	walk		Fairman and Miller 1990	
Pipe Creek												
11			11			6	6	1989	walk		Fairman, Genter, and Miller 1989	
11	5364600	603980	11	5369010	607130	21	7	1989	walk		Kerr 1989	
11	5378790	607070	11	5364600	603980	5	7	1990	walk		Fairman and Miller 1990	
Pipe Creek, East Fork												
11	5391750	606670	11	5385530	601890	13	6	1990	walk		Fairman and Miller 1990	
Quartz Creek												
11	5366550	601440	11	5365700	600800	23	5	1989			Fairman, Genter, and Miller 1989	
11	5375900	599100	11	5365700	600800	22	7	1989			Kerr 1989	
11	5366550	601440	11	5365700	600800	8	5	1990			Fairman, Genter, and Miller 1990	
11	5374550	599180	11	5372140	599470	8	5	1990			Fairman, Genter, and Miller 1990	
11	5379000	598770	11	5367720	600960	14	6	1990			Fairman, Genter, and Miller 1990	
West Fork Quartz Creek												
11	5373060	597500	11	5370200	599550	23	6	1990			Fairman, Genter, and Miller 1990	
Pinkham Creek												
						26	5	1989			Fairman, Genter, and Miller 198	unknown stream segment
11	5410380	637190	11	5410070	630080	12	6	1990			Fairman, Genter, and Miller 1990	
Pipe Creek												
11	5364600	603980	11	5369010	607130	9	6	1989			Fairman, Genter, and Miller 1989	
11	5364600	603980	11	5369010	607130	21	7	1989			Kerr 1989	
11	5378790	607070	11	5364600	603980	5	7	1990			Fairman and Miller 1990	
Pipe Creek, East Fork												
11	5391750	606670	11	5385530	601890	13	6	1990			Fairman and Miller 1990	
Ross Creek												
						12	7	1988			Miller 1988	unknown stream segment
11	5339700	580700	11	5339180	582450	20	6	1990	walk		Fairman and Miller 1990	
11	5339700	580700	11	5339730	584030	31	7	1990	walk		Fairman and Miller 1990	
Spar Creek												
11	5346660	577780	11	5344550	577830	24	5	1989	walk		Fairman, Genter, and Miller 198	Spar Lake
Sutton Creek												
						26	5	1989	walk		Fairman, Genter, and Miller 198	unknown stream segment

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream	Upper UTM			Lower UTM						#		
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
Wigwam River													
	11	5425800	657200	11	5427300	658660	8	7	1992	walk		Reichel and Genter 1993	
	11	5427760	659010	11	5425810	657210	6	6	1994			Reichel and Genter 1993	
Young Creek													
							26	5	1989			Fairman, Genter, and Miller 198	unknown stream segment
Fisher River Drainage: 17010102													
Fisher River (tributaries covered separately)													
	11	5341600	628380	11	5357680	624450	9	7	1990	walk		Fairman and Miller 1990	
	11	5325180	621150	11	5357680	624450	20	8	1990	walk		Fairman and Miller 1990	
Fisher River, East													
							20	6	1989	walk		Fairman and Miller 1990	unknown stream segment
Fisher River, Silver Butte													
	11	5318190	621810	11	5313980	616290	12	8	1989	walk		Kerr 1989	
Fisher River, West													
	11	5323080	617200	11	5324510	620450	19	6	1989	walk		Fairman, Genter, and Miller 1989	
	11	5323520	611700	11	5324510	620450	11	8	1989	walk		Kerr 1989	
	11	5323520	611700	11	5324510	620450	3	7	1990	walk		Fairman, Genter, and Miller 1990	
	11	5321520	614860	11	5324510	620450	15	8	1990	walk		Fairman, Genter, and Miller 1990	
Wolf Creek													
							5	6	1989	walk		Fairman, Genter, and Miller 199	unknown stream segment
Yaak River Drainage: 17010103													
Basin Creek													
							11	7	1990	walk		Merz 1991	unknown stream segment
Pete Creek													
							25	5	1989	walk		Fairman, Genter, and Miller 198	unknown stream segment
	11	5416500	587400	11	5409150	590410	1	7	1990	walk		Fairman and Miller 1990	1-2 July 1990
	11	5417690	586610	11	5409150	590410	15	7	1991	walk		Merz 1991	
Seventeenmile Creek													
	11	5392050	585530	11	5392080	587500	25	5	1989			Fairman, Genter, and Miller 1989	
	11	5389560	591310	11	5391600	587500	19	8	1989			Kerr 1989	
	11	5391120	588700	11	5392080	587500	21	5	1990			Fairman, Genter, and Miller 1990	
	11	5391120	588700	11	5392080	587500	13	7	1990			Fairman, Genter, and Miller 1990	
Spread Creek													
	11	5408200	584300	11	5407750	584400	25	5	1989			Fairman, Genter, and Miller 1989	
	11	5413100	578580	11	5407750	584400	18	8	1989			Kerr 1989	
	11	5410650	583090	11	5407750	584400	21	5	1990			Fairman, Genter, and Miller 1990	

Appendix H. Harlequin Duck Surveys in Montana 1937-94.

Drainage: Hydologic Code

Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
11	5410650	583090	11	5407750	584400	11	7	1990			Fairman, Genter, and Miller 1990	
11	5413100	578580	11	5407750	584400	15	7	1991			Merz 1991	
Yaak River (tributaries covered separately)												
11	5411730	598160	11	5396820	582820	31	7	1989			Kerr 1989	31 July & 18 Aug 1989
11	5417780	598180	11	5409300	594970	22	5	1990			Fairman and Miller 1990	
11	5409210	588120	11	5406320	582720	1	7	1990			Fairman and Miller 1990	
						4	7	1990			Fairman and Miller 1990	numerous sites
11	5406320	582720	11	5388750	582190	7	8	1990			Fairman and Miller 1990	7-10 Aug 1990
11	5419510	598040	11	5388750	582190	17	7	1991			Merz 1991	
11	5405330	580300	11	5392850	584110	29	5	1993	boat		Reichel and Genter 1994	
Yaak River, East Fork (tributaries covered separately)												
11	5422180	601810	11	5420950	612150	31	7	1989			Kerr 1989	31 July & 17 Aug 1989
11	5422040	610530	11	5422870	601430	16	7	1990			Fairman and Miller 1990	16-17 July 1990
Yaak River, North Fork (tributaries covered separately)												
11	5422870	601430	11	5427880	599390	17	8	1989			Kerr 1989	
11	5426660	600450	11	5422870	601430	20	5	1990			Fairman and Miller 1990	
11	5427880	599390	11	5422870	601430	16	7	1990			Fairman and Miller 1990	
Yaak River, South Fork (tributaries covered separately)												
11	5407290	596180	11	5399080	599540	19	8	1989			Kerr 1989	
11	5404600	598040	11	5408780	596310	9	8	1990			Fairman and Miller 1990	
Yaak River, West Fork (tributaries covered separately)												
11	5420330	593780	11	5420730	597300	26	5	1989			Fairman, Genter, and Miller 1989	
11	5423250	591800	11	5420330	593780	29	7	1989			Kerr 1989	
11	5420330	593780	11	5420730	597300	20	5	1990			Fairman, Genter, and Miller 1990	
11	5423250	591800	11	5420730	597300	14	7	1990			Fairman, Genter, and Miller 1990	
11	5421050	597700	11	5427900	568650	20	7	1990			Fairman, Genter, and Miller 1990	
11	5420400	593400	11	5420730	597300	22	7	1990			Fairman, Genter, and Miller 1990	
CLARK FORK RIVER DRAINAGE: 170102												
Rock Creek Drainage: 17010202												
Rock Creek (tributaries covered separately)												
12	5165090	296670	12	5177950	294950	31	8	1990			Fairman and Miller 1990	
Blackfoot River Drainage: 17010203												
Blackfoot River (tributaries covered separately)												
Blackfoot River, Lander's Fork (tributaries covered separately)												
12	5219700	379100	12	5203700	381700	14	7	1994	boat		Reichel and Genter 1995	
Blackfoot River, North Fork												

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code / Stream	Upper UTM		Lower UTM							#		
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type seen	Source	Comments
	12	5223800	353250	12	5228570	355050	28	8	1991		Castren 1991	
	12	5228570	355050	12	5209250	346060	21	8	1992		Reichel and Genter 1993	21-22 Aug 1992
	12	5219490	350570	12	5209250	346060	15	6	1993		Reichel and Genter 1994	
	12	5227710	354940	12	5213170	351130	21	7	1993		Reichel and Genter 1994	
	12	5227710	354940	12	5223800	353270	15	7	1994		Reichel and Genter 1995	
Monture Creek												
	12	5220340	337230	12	5222880	336530	27	8	1991		Castren 1991	
	12	5227470	336250	12	5221830	336840	13	7	1994		Reichel and Genter 1995	
Middle Clark Fork River Drainage: 17010204												
Big Creek												
	11	5246560	617770	11	5247670	620910	16	6	1989		Miller 1989	
	11	5246560	617770	11	5247670	620910	25	7	1989		Miller 1989	25-26 July 1989
	11	5245260	615400	11	5247670	620910	2	7	1990		Fairman and Miller 1990	
	11	5245260	615400	11	5247670	620910	29	8	1990		Fairman and Miller 1990	
Cedar Creek												
	11	5222880	653320	11	5226950	661920	21	6	1989		Miller 1989	
	11	5222880	653320	11	5226950	661920	2	8	1989		Miller 1989	
Deer Creek												
	11	5246030	623480	11	5248150	623850	25	7	1989		Miller 1989	
Little Joe Creek												
	11	5235490	638830	11	5239630	642130	20	6	1989		Miller 1989	
	11	5235490	638830	11	5239630	642130	31	7	1989		Miller 1989	
Packer Creek												
	11	5256000	613250	11	5251740	612400	15	6	1989		Miller 1989	
	11	5253400	612050	11	5251740	612400	26	7	1989		Miller 1989	
Packer Creek, West Fork												
	11	5255320	610800	11	5253400	612050	16	6	1989		Miller 1989	
St. Regis River (tributaries covered separately)												
	11	5252020	607420	11	5239630	643990	13	6	1989		Miller 1989	13-14 June 1989
	11	5252020	607420	11	5239630	643990	13	6	1989		Miller 1989	25-27 July 1989
	11	5248190	623900	11	5241130	633610	3	7	1990		Fairman and Miller 1990	
	11	5248190	623900	11	5241130	633610	28	8	1990		Fairman and Miller 1990	
Trout Creek												
	11	5216190	658100	11	5322320	663080	22	6	1989	6	Fairman and Miller 1990	
	11	5212870	656230	11	5322320	663080	1	8	1989	5	Miller 1989	
	11	5211950	655780	11	5322320	663080	5	7	1990	1	Fairman, Genter, and Miller 199	5-6 Jul 1990
	11	5211950	655780	11	5323170	664620	29	8	1990		Fairman, Genter, and Miller 199	29-30 Aug 1990

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream	Upper UTM zon	Upper UTM N/S utm	Upper UTM E/W utm	Lower UTM zon	Lower UTM N/S utm	Lower UTM E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
	11	5217880	659080	11	5323170	664620	17	8	1991			Merz 1991	
	11	5214300	657400	11	5216190	658100	17	8	1991			Merz 1991	
	11	5214300	657400	11	5322730	663690	7	8	1992	walk		Reichel and Genter 1993	
	11	5207630	652850	11	5322730	663690	4	8	1993	walk		Reichel and Genter 1994	
Twelvemile Creek													
	11	5247750	631260	11	5245220	629090	19	6	1989			Miller 1989	
	11	5249460	632210	11	5245220	629090	27	7	1989			Miller 1989	
Ward Creek													
	11	5239800	632150	11	5241130	633540	31	7	1989			Miller 1989	
North Fork Flathead River Drainage: 17010206													
Akakola Creek													
	11	5408940	698690	11	5407140	699470	18	8	1993	walk		Ashley 1994b	
Big Creek													
	11	5386250	704680	11	5387080	709130	17	5	1990		2	Carlson 1990	
	11	5386250	704680	11	5387080	709130	9	8	1990			Carlson 1990	
	11	5386250	704680	11	5387080	709130	15	5	1992			Reichel and Genter 1993	
	11	5384450	698940	11	5387080	709130	12	6	1992			Reichel and Genter 1993	
	11	5383270	698180	11	5387080	709130	14	8	1992			Reichel and Genter 1993	
	11	5383270	698180	11	5387080	709130	5	5	1993		1	Reichel and Genter 1993	
	11	5383950	698320	11	5387080	709130	9	8	1993			Reichel and Genter 1994	
	11	5386250	704680	11	5387080	709130	19	5	1994			Reichel and Genter 1995	
	11	5383950	698320	11	5386250	704680	3	6	1994		2	Reichel and Genter 1995	
	11	5383950	698320	11	5387080	709130	2	8	1994			Reichel and Genter 1995	
Bowman Creek													
	11	5411920	705810	11	5406720	699220	18	8	1993			Ashley 1994b	
Canyon Creek													
	11	5376530	703530	11	5376050	707810	17	5	1990			Carlson 1990	
	11	5376530	703530	11	5376050	707810	9	8	1990			Carlson 1990	
	11	5376050	707810	11	5376450	711310	4	6	1994			Reichel and Genter 1995	
Coal Creek													
	11	5394330	704820	11	5396590	706510	16	5	1990			Carlson 1990	
	11	5393790	702750	11	5396590	706510	11	8	1990			Carlson 1990	
	11	5394330	704820	11	5396590	706510	13	6	1992			Reichel and Genter 1993	
	11	5394310	690770	11	5394550	697570	13	8	1992			Reichel and Genter 1993	
	11	5393790	702750	11	5396590	706510	17	6	1993			Reichel and Genter 1994	
	11	5393790	702750	11	5396590	706510	13	5	1994			Reichel and Genter 1995	
	11	5394550	697570	11	5393790	702750	8	6	1994			Reichel and Genter 1995	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code / Stream	Upper UTM zon	Upper UTM N/S utm	Upper UTM E/W utm	Lower UTM zon	Lower UTM N/S utm	Lower UTM E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
Hay Creek													
								6	1989			Fairman, Genter, and Miller 198	survey segment unknown
									1991			Gangemi 1991	survey segment unknown
Kintla Creek													
	11	5423460	694510	11	5421070	692440	19	8	1993			Ashley 1994b	
	11	5428380	704630	11	5427990	701620	29	7	1994			Ashley 1994a	
	11	5428870	708740	11	5428540	708690	30	7	1994			Ashley 1994a	
Kishenehn Creek													
	11	5430700	692890	11	5424950	698530	5	8	1993			Ashley 1994a	
Moose Creek													
									1991			Gangemi 1991	survey segment unknown
Moran Creek													
									1991			Gangemi 1991	survey segment unknown
North Fork Flathead River (tributaries covered separately)													
							6	8	1991		1	Gangemi 1991	survey segment unknown
	11	5430420	684710	11	5406600	699820	12	8	1993			Ashley 1994b	
	11	5430420	684710	11	5413930	694260	14	5	1992		3	Reichel and Genter 1993	
	11	5394780	706930	11	5390730	709620	1	4	1993		3	Reichel and Genter 1994	
	11	5394330	704820	11	5384160	710440	17	6	1993			Reichel and Genter 1994	
Red Meadow Creek													
	11	5410050	691050	11	5409150	694800	30	5	1990			Carlson 1990	
	11	5410050	691050	11	5409150	694800	8	8	1990			Carlson 1990	
	11	5410050	691050	11	5409050	696490	13	8	1992			Reichel and Genter 1993	
Trail Creek													
								6	1989			Fairman, Genter, and Miller 198	survey segment unknown
	11	5421900	687500	11	5421700	689930	6	5	1990		8	Carlson 1990	
	11	5423550	681800	11	5421700	689930	14	5	1990		10	Carlson 1990	
	11	5423550	681800	11	5421700	689930	7	8	1990		8	Carlson 1990	
							5	8	1991		9	Gangemi 1991	survey segment unknown
	11	5423550	681800	11	5421700	689930	14	5	1992		8	Reichel and Genter 1993	
	11	5423550	681800	11	5421700	689930	10	6	1992		6	Reichel and Genter 1993	9-11 June 1992
	11	5422450	680000	11	5421700	689930	12	8	1992		10	Reichel and Genter 1993	
	11	5422930	680830	11	5422000	691400	8	5	1993		15	Reichel and Genter 1994	
	11	5423400	681380	11	5421900	687500	9	5	1993		13	Reichel and Genter 1994	
	11	5423100	681060	11	5421900	687500	13	8	1993		10	Reichel and Genter 1994	
	11	5422450	680000	11	5422000	691400	9	5	1994	walk	12	Reichel and Genter 1994	
	11	5422450	680000	11	5422000	691400	1	8	1994	walk	6	Reichel and Genter 1994	1-2 Aug 1994
Tuchuck Creek													

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
								1991			Gangemi 1991	survey segment unknown
Yakinikak Creek												
								1991			Gangemi 1991	survey segment unknown
Whale Creek												
							6	1989			Fairman, Genter, and Miller 1989	
11	5415370	686130	11	5414090	693550	15	5	1990			Carlson 1990	
11	5415370	686130	11	5414090	693550	11	8	1990			Carlson 1990	
								1991			Gangemi 1991	survey segment unknown
11	5413480	675900	11	5414090	693550	12	8	1993			Reichel and Genter 1994	
Akinkoka Creek												
								1991			Gangemi 1991	survey segment unknown
Ninko Creek												
								1991			Gangemi 1991	survey segment unknown
Shorty Creek												
								1991			Gangemi 1991	survey segment unknown
11	5410720	675550	11	5413590	676530	12	8	1993			Reichel and Genter 1994	
Middle Fork Flathead River Drainage: 17010207												
Dolly Varden Creek												
12	5325910	332670	12	5320440	336240	18	8	1991			Castren 1991	
12	5322240	335090	12	5325910	332670	30	7	1993			Reichel and Genter 1994	30-31 July 1993
Fish Creek												
12	5383090	279300	12	5381090	279970	11	5	1994		2	Ashley 1994b	
12	5383090	279300	12	5381090	279970	4	6	1994			Ashley 1994b	
12	5383090	279300	12	5381090	279970	6	8	1994			Ashley 1994b	
12	5381490	279760	12	5381090	279970	24	5	1994			Ashley 1994a	
12	5381490	279760	12	5381090	279970	4	5	1994			Ashley 1994a	
12	5383090	279300	12	5381090	279970	9	5	1994		5	Ashley 1994a	
12	5381490	279760	12	5381090	279970	25	7	1994			Ashley 1994a	
12	5383090	279300	12	5381090	279970	1	8	1994			Ashley 1994a	
12	5386930	289260	12	5386620	289220	27	5	1993			Ashley 1994b	
Fern Creek												
12	5382070	278940	12	5381820	279660	9	5	1994			Ashley 1994a	
Jackson Creek												
12	5387300	289320	12	5388140	287610	28	5	1993			Ashley 1994b	
12	5387900	288600	12	5388140	287610	24	4	1994			Ashley 1994a	
12	5387300	289320	12	5388140	287610	18	5	1994			Ashley 1994a	
Lake Creek												

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
12	5330120	327280	12	5331280	325640	31	7	1993			Reichel and Genter 1994	
Long Creek												
12	5336590	311940	12	5334230	321340	1	8	1993			Reichel and Genter 1994	
McDonald Creek (tributaries covered separately)												
11	5376610	721230	12	5379300	278960	14	6	1994			Ashley 1994b	
12	5376610	721230	12	5379300	278960	15	4	1994			Ashley 1994a	
12	5400330	296730	12	5390390	288650	17	4	1974		3	Kuchel 1977	
12	5400330	296730	12	5390390	288650	24	4	1974		5	Kuchel 1977	
12	5400330	296730	12	5390390	288650	1	5	1974		23	Kuchel 1977	
12	5400330	296730	12	5390390	288650	8	5	1974		20	Kuchel 1977	
12	5400330	296730	12	5390390	288650	15	5	1974		31	Kuchel 1977	
12	5400330	296730	12	5390390	288650	22	5	1974		32	Kuchel 1977	
12	5400330	296730	12	5390390	288650	29	5	1974		32	Kuchel 1977	
12	5400330	296730	12	5390390	288650	5	6	1974		23	Kuchel 1977	
12	5400330	296730	12	5390390	288650	12	6	1974		12	Kuchel 1977	
12	5400330	296730	12	5390390	288650	19	6	1974		11	Kuchel 1977	
12	5400330	296730	12	5390390	288650	26	6	1974		11	Kuchel 1977	
12	5400330	296730	12	5390390	288650	3	7	1974		11	Kuchel 1977	
12	5400330	296730	12	5390390	288650	10	7	1974		9	Kuchel 1977	
12	5400330	296730	12	5390390	288650	17	4	1975		2	Kuchel 1977	
12	5400330	296730	12	5390390	288650	24	4	1975		4	Kuchel 1977	
12	5400330	296730	12	5390390	288650	1	5	1975		26	Kuchel 1977	
12	5400330	296730	12	5390390	288650	8	5	1975		30	Kuchel 1977	
12	5400330	296730	12	5390390	288650	15	5	1975		40	Kuchel 1977	
12	5400330	296730	12	5390390	288650	22	5	1975		41	Kuchel 1977	
12	5400330	296730	12	5390390	288650	29	5	1975		40	Kuchel 1977	
12	5400330	296730	12	5390390	288650	5	6	1975		43	Kuchel 1977	
12	5400330	296730	12	5390390	288650	12	6	1975		33	Kuchel 1977	
12	5400330	296730	12	5390390	288650	19	6	1975		24	Kuchel 1977	
12	5400330	296730	12	5390390	288650	26	6	1975		20	Kuchel 1977	
12	5400330	296730	12	5390390	288650	3	7	1975		15	Kuchel 1977	
12	5400330	296730	12	5390390	288650	10	7	1975		10	Kuchel 1977	
12	5404230	292670	12	5390390	288650	10	8	1992		43	Reichel and Genter 1993	10-11 Aug 1992
12	5400330	296730	12	5390390	288650	2	9	1992		27	Reichel and Genter 1993	
12	5400330	296730	12	5390390	288650	17	4	1993		2	Ashley 1994b	
12	5400330	296730	12	5390390	288650	24	4	1993		7	Ashley 1994b	
12	5400330	296730	12	5390390	288650	1	5	1993		21	Ashley 1994b	
12	5400330	296730	12	5390390	288650	8	5	1993		37	Ashley 1994b	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
12	5400330	296730	12	5390390	288650	15	5	1993		21	Ashley 1994b	
12	5400330	296730	12	5390390	288650	25	5	1993		22	Ashley 1994b	
12	5403580	292390	12	5400330	296730	26	5	1993		10	Ashley 1994b	
12	5408750	286890	12	5403580	292390	10	6	1993		3	Ashley 1994b	
12	5400330	296730	12	5390390	288650	8	6	1993		27	Ashley 1994b	
12	5400330	296730	12	5390390	288650	15	6	1993		15	Ashley 1994b	
12	5400330	296730	12	5390390	288650	22	6	1993		12	Ashley 1994b	
12	5400330	296730	12	5390390	288650	29	6	1993		11	Ashley 1994b	
12	5400330	296730	12	5390390	288650	6	7	1993		16	Ashley 1994b	
12	5400330	296730	12	5390390	288650	13	7	1993		13	Ashley 1994b	
12	5400330	296730	12	5390390	288650	20	7	1993		14	Ashley 1994b	
12	5400330	296730	12	5390390	288650	27	7	1993		13	Ashley 1994b	
12	5400330	296730	12	5390390	288650	3	8	1993		9	Ashley 1994b	
12	5400330	296730	12	5390390	288650	10	8	1993		3	Ashley 1994b	
12	5400330	296730	12	5390390	288650	17	8	1993		3	Ashley 1994b	
12	5400330	296730	12	5390390	288650	24	8	1993		13	Ashley 1994b	
12	5400330	296730	12	5390390	288650	31	8	1993		14	Ashley 1994b	
12	5400330	296730	12	5390390	288650	14	9	1993		5	Ashley 1994b	
12	5400330	296730	12	5390390	288650	22	9	1993		5	Ashley 1994b	
12	5400330	296730	12	5390390	288650	30	9	1993			Ashley 1994b	
12	5404230	292670	12	5390390	288650	10	8	1993		20	Reichel and Genter 1994	10-11 Aug 1993
12	5400330	296730	12	5390390	288650	28	4	1994		33	Ashley 1994a	
12	5400330	296730	12	5390390	288650	8	6	1994		10	Ashley 1994a	
12	5400330	296730	12	5390390	288650	3	8	1994		19	Ashley 1994a	
12	5400330	296730	12	5390390	288650	16	8	1994		10	Ashley 1994a	
12	5403580	292390	12	5400330	296730	28	4	1994		6	Ashley 1994a	
12	5390390	288650	12	5400330	296730	3	8	1994		8	Ashley 1994a	
12	5390390	288650	12	5400330	296730	4	8	1994		6	Ashley 1994a	
12	5404870	290430	12	5403580	292390	3	8	1994			Ashley 1994a	
Avalanche Creek												
12	5392030	295830	12	5392290	295060	3	6	1993			Ashley 1994b	
12	5392290	295060	12	5393230	294640	10	5	1993		2	Ashley 1994b	
12	5392290	295060	12	5393230	294640	7	7	1993			Ashley 1994b	
12	5392290	295060	12	5393230	294640	2	8	1993			Ashley 1994b	
12	5392290	295060	12	5393230	294640	10	8	1993			Ashley 1994b	
12	5392290	295060	12	5393230	294640	17	8	1993		3	Ashley 1994b	
12	5392290	295060	12	5393230	294640	5	9	1993			Ashley 1994b	
12	5393230	294640	12	5395540	292450	10	5	1993		4	Ashley 1994b	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code / Stream	Upper UTM		Lower UTM							#		
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type seen	Source	Comments
	12	5393230	294640	12	5395540	292450	3	6	1993	2	Ashley 1994b	
	12	5393230	294640	12	5395540	292450	2	8	1993		Ashley 1994b	
	12	5395540	292450	12	5393230	294640	1	8	1993		Reichel and Genter 1994	
	12	5393230	294640	12	5395540	292450	9	5	1994	2	Ashley 1994a	
	12	5393230	294640	12	5395540	292450	8	6	1994		Ashley 1994a	
	12	5392290	295060	12	5393230	294640	9	5	1994	2	Ashley 1994a	
	12	5392290	295060	12	5393230	294640	8	6	1994		Ashley 1994a	
	12	5392290	295060	12	5393230	294640	22	7	1994		Ashley 1994a	
Logan Creek												
	12	5399700	298350	12	5400330	296730	16	5	1993		Ashley 1994b	
Mineral Creek												
	12	5404240	292650	12	5403580	292390	16	5	1993		Ashley 1994b	
	12	5404240	292650	12	5403580	292390	26	5	1993		Ashley 1994b	
	12	5404240	292650	12	5403580	292390	28	5	1994	2	Ashley 1994a	
	12	5404240	292650	12	5403580	292390	3	8	1994		Ashley 1994a	
	12	5404240	292650	12	5403580	292390	4	8	1994		Ashley 1994a	
	12	5404240	292650	12	5403580	292390	11	8	1992	3	Reichel and Genter 1993	
	12	5404240	292650	12	5403580	292390	11	8	1993	3	Reichel and Genter 1994	
Middle Fork Flathead River (tributaries covered seperately)												
	12	5318340	345210	12	5345280	309430	20	8	1991		Castren 1991	20-23 Aug 1991
	12	5345280	309430	12	5366360	296270	30	7	1992		Reichel and Genter 1993	30-31 Jul 1992
	12	5330950	328160	12	5349830	306190	1	8	1993	11	Reichel and Genter 1994	1-3 Aug 1993
Morrison Creek												
	12	5335560	331930	12	5344230	331810	28	7	1993		Reichel and Genter 1994	28-29 July 1993
Ole Creek												
	12	5351850	312750	12	5351740	307270	12	8	1992		Reichel and Genter 1993	
Schafer Creek												
	12	5324900	332640	12	5326450	332360	21	8	1991		Castren 1991	
	12	5322260	330340	12	5326450	332360	30	7	1993		Reichel and Genter 1994	
Snyder Creek												
	12	5387690	290020	12	5388700	287760	27	5	1993		Ashley 1994b	
	12	5387690	290020	12	5388700	287760	20	5	1994	4	Ashley 1994a	
	12	5388170	288710	12	5388700	287760	24	5	1994		Ashley 1994a	
Sprague Creek												
	12	5387050	298330	12	5387560	287450	27	5	1993	4	Ashley 1994b	
	12	5386610	287900	12	5387560	287450	24	4	1994		Ashley 1994a	
	12	5386970	287700	12	5387560	287450	11	5	1994		Ashley 1994a	
	12	5387050	298330	12	5387560	287450	18	5	1994		Ashley 1994a	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream	Upper UTM			Lower UTM							#		
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
	12	5386970	287700	12	5387560	287450	1	8	1994			Ashley 1994a	
Strawberry Creek													
	12	5318530	347830	12	5317680	346510	20	8	1991			Castren 1991	
unnamed creek													
	12	5380860	284230	12	5381900	283000	24	4	1994			Ashley 1994a	
South Fork Flathead River Drainage: 17010209													
Aeneas Creek													
	12	5334550	288450	12	5334280	290140	31	8	1989			Miller 1989	
Babcock Creek													
	12	5247590	321460	12	5248130	328660	22	7	1991			Castren 1991	
	12	5248040	325710	12	5248130	328660	16	7	1992			Reichel and Genter 1993	
Bartlett Creek													
	12	5263100	327390	12	5264480	328800	19	7	1992			Reichel and Genter 1993	
Big Salmon Creek													
	12	5270940	312360	12	5276540	322850	2	8	1991			Castren 1991	
	12	5269580	310480	12	5272190	315980	22	7	1992			Reichel and Genter 1993	
	12	5276540	322850	12	5278090	322950	23	7	1992			Reichel and Genter 1993	
Bunker Creek													
	12	5298280	316140	12	5299980	319230	5	6	1990			Carlson 1990	
	12	5297290	313960	12	5299980	319230	2	8	1990			Carlson 1990	
	12	5297290	313960	12	5299980	319230	6	8	1991			Castren 1991	
	12	5297290	313960	12	5299980	319230	22	6	1992			Reichel and Genter 1993	
	12	5297290	313960	12	5299980	319230	26	5	1994			Reichel and Genter 1993	
Clayton Creek													
	12	5344560	286420	12	5346650	288000	30	8	1989			Miller 1989	
Danaher Creek													
	12	5248300	344900	12	5256750	355440	24	7	1991			Castren 1991	
	12	5253540	340220	12	5256750	355440	17	7	1992			Reichel and Genter 1993	
Doris Creek													
	12	5353430	278230	12	5354340	278930	20	6	1990			Carlson 1990	
	12	5353430	278230	12	5354340	278930	3	8	1990			Carlson 1990	
	11	5352020	720060	12	5353430	278230	6	8	1992			Reichel and Genter 1993	
Emery Creek													
	12	5362140	283230	12	5359840	283200	1	9	1989			Miller 1989	
	12	5364360	284380	12	5359840	283200	6	6	1990			Carlson 1990	
	12	5364360	284380	12	5359840	283200	10	8	1990			Carlson 1990	
Fawn Creek													

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
								1991			Gangemi 1991	survey segment unknown
Gordon Creek												
12	5256390	328670	12	5255460	327500	27	6	1991			Castren 1991	
12	5253090	320060	12	5255460	327500	18	7	1991			Castren 1991	
12	5255460	320500	12	5260520	332450	18	7	1992			Reichel and Genter 1993	
Graves Creek												
12	5338700	287320	12	5333880	291060	30	8	1989			Miller 1989	30-31 August 1989
Holbrook Creek												
12	5271290	325410	12	5272290	327060	30	7	1991			Castren 1991	
Hungry Horse Creek												
12	5358540	288780	12	5358670	284760	1	9	1989			Miller 1989	
12	5359350	287340	12	5358670	284760	6	6	1990			Carlson 1990	
12	5359350	287340	12	5358670	284760	10	8	1990			Carlson 1990	
Little Salmon Creek												
12	5279850	316080	12	5280400	322800	3	8	1991		1	Castren 1991	
12	5280400	313030	12	5280400	322800	23	7	1992		10	Reichel and Genter 1993	23-24 July 1992
12	5280170	308030	12	5280400	322800	21	7	1994		8	Reichel and Genter 1995	21, 24-25 July 1994
Lost Johnny Creek												
12	5352410	279330	12	5354280	279970	22	5	1990			Carlson 1990	
12	5351510	279090	12	5354280	279970	20	6	1990			Carlson 1990	
12	5351510	279090	12	5354280	279970	10	8	1990			Carlson 1990	
Mid Creek												
12	5295470	321000	12	5294800	319730	23	6	1992			Reichel and Genter 1993	
Riverside Creek												
12	5352890	290920	12	5352080	292750	26	8	1991			Castren 1991	
Ryle Creek												
12	5354100	291500	12	5352400	290980	26	8	1991			Castren 1991	
South Fork Flathead River (tributaries covered separately)												
12	5256750	335440	12	5271600	326550	24	6	1991		2	Castren 1991	24-28 June 1991
12	5296000	319000	12	5300250	319260	2	7	1991			Castren 1991	
12	5260520	332450	12	5319800	307120	29	7	****		3	Castren 1991	29 July - 5 August 1991
12	5300250	319260	12	5319800	307120	25	8	1991			Castren 1991	
12	5294800	319730	12	5319800	307120	23	6	1992			Reichel and Genter 1993	
12	5356750	335440	12	5311600	310550	26	7	1992		4	Reichel and Genter 1993	26-27 July 1992
Spotted Bear River												
12	5312400	317300	12	5311600	310500	4	6	1990			Carlson 1990	
12	5310200	323050	12	5311600	310500	1	8	1990			Carlson 1990	
12	5302880	339680	12	5311600	310500	10	7	1991		2	Castren 1991	7-14 July 1991

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream	Upper UTM zon	Upper UTM N/S utm	Upper UTM E/W utm	Lower UTM zon	Lower UTM N/S utm	Lower UTM E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
	12	5310350	328960	12	5311600	310500	24	6	1992			Reichel and Genter 1993	
	12	5311150	327900	12	5311600	310500	13	8	1992		8	Reichel and Genter 1993	
	12	5307070	332600	12	5311600	310500	14	8	1993		5	Reichel and Genter 1994	14-15 Aug 1993
	12	5310200	323050	12	5311600	310500	9	6	1994		2	Reichel and Genter 1995	
	12	5307520	331420	12	5311600	310500	5	8	1994		14	Reichel and Genter 1995	
Sullivan Creek													
	12	5316780	300800	12	5320250	298100	20	6	1990			Carlson 1990	
	12	5316780	300800	12	5320250	298100	30	7	1990		5	Carlson 1990	
							19	8	1991		2	Gangemi 1991	survey segment unknown
	12	5316100	301900	12	5324950	299750	25	6	1992		2	Reichel and Genter 1993	
	12	5316780	300800	12	5324950	299750	8	8	1992		2	Reichel and Genter 1993	
	12	5314600	302270	12	5316780	300800	4	5	1993			Reichel and Genter 1994	
	12	5316780	300800	12	5325900	299850	5	5	1993			Reichel and Genter 1994	
	12	5316780	300800	12	5324950	299750	16	8	1993			Reichel and Genter 1994	
	12	5316100	301900	12	5324950	299750	9	6	1994		2	Reichel and Genter 1995	
	12	5316780	300800	12	5324950	299750	5	8	1994		14	Reichel and Genter 1995	
Ball Creek													
									1991			Gangemi 1991	survey segment unknown
Branch Creek													
									1991			Gangemi 1991	survey segment unknown
Conner Creek													
									1991			Gangemi 1991	survey segment unknown
Quintonkon Creek													
	12	5322210	297200	12	5322480	298220	30	7	1990			Carlson 1990	
	12	5321130	292550	12	5322480	298220	26	6	1992			Reichel and Genter 1993	
Slide Creek													
									1991			Gangemi 1991	survey segment unknown
Upper Twin Creek													
	12	5316400	311320	12	5317520	308720	23	6	1992			Reichel and Genter 1993	
	12	5319420	315080	12	5317520	308720	27	5	1994			Reichel and Genter 1995	
Wheeler Creek													
	12	5328870	295200	12	5330500	296800	7	8	1991			Castren 1991	
	12	5328870	295200	12	5330500	296800	9	8	1992			Reichel and Genter 1993	
White River													
	12	5270980	332450	12	5272860	327220	31	7	1991			Castren 1991	
	12	5276350	334270	12	5272860	327220	19	7	1992		9	Reichel and Genter 1993	19-21 July 1992
	12	5280330	334000	12	5272860	327220	22	7	1994		24	Reichel and Genter 1995	22-23 July 1994
White River, South Fork													

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
Drainage: Hydologic Code												
Stream												
12	5271420	336520	12	5372130	334710	20	7	1992			Reichel and Genter 1993	
Wounded Buck Creek												
12	5347400	280600	12	5351320	282250	30	8	1989		4	Miller 1989	
12	5347400	280600	12	5351320	282250	22	5	1990			Carlson 1990	
12	5347400	280600	12	5351320	282250	6	6	1990			Carlson 1990	
12	5347400	280600	12	5351320	282250	31	7	1990		1	Carlson 1990	
12	5348600	280500	12	5350210	281430	5	6	1992			Reichel and Genter 1993	
12	5347400	280600	12	5351320	282250	7	8	1992			Reichel and Genter 1993	
Wildcat Creek												
								1991			Gangemi 1991	survey segment unknown
Youngs Creek												
12	5242930	326830	12	5256750	335440	21	7	1991			Castren 1991	
12	5241320	326800	12	5256750	335440	15	7	1992			Reichel and Genter 1993	15-17 July 1992
Stillwater River Drainage: 17010210												
Good Creek												
11	5372180	667330	11	5374400	675000	31	8	1989			Kerr 1989	
11	5372730	671140	11	5374670	674450	21	5	1990			Carlson 1990	
11	5372730	671140	11	5374670	674450	23	7	1990			Carlson 1990	
Fitzsimmons Creek												
							5	1989			Fairman, Genter, and Miller 198	survey segment unknown
Logan Creek												
11	5363100	673650	11	5364890	679100	14	5	1989			Kerr 1989	
11	5365690	673680	11	5364890	679100	21	5	1990			Carlson 1990	
11	5363100	673650	11	5364890	679100	21	6	1990			Carlson 1990	
11	5363100	673650	11	5364890	679100	24	7	1990			Carlson 1990	
Stillwater River												
							5	1989			Fairman, Genter, and Miller 198	survey segment unknown
11	5400400	666570	11	5395310	666560	4	6	1990			Carlson 1990	
11	5400400	666570	11	5395310	666560	27	7	1990			Carlson 1990	
								1991			Gangemi 1991	survey segment unknown
11	5397360	666910	11	5393360	664850	25	5	1994			Reichel and Genter 1995	
11	5400400	666570	11	5397360	666910	6	6	1994			Reichel and Genter 1995	
Swift Creek												
							5	1989			Fairman, Genter, and Miller 198	survey segment unknown
11	5391000	680670	11	5386780	683160	15	6	1990			Carlson 1990	
11	5391940	680440	11	5386780	683160	28	7	1990		1	Carlson 1990	
						23	7	1991		1	Gangemi 1991	survey segment unknown

Drainage: Hydologic Code
Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
11	5391940	680440	11	5386780	683160	11	5	1994		1	Reichel and Genter 1995	
11	5386780	683160	11	5373150	689720	23	5	1994		4	Reichel and Genter 1995	
11	5384680	684640	11	5373150	689720	10	8	1994			Reichel and Genter 1995	
Swan River Drainage: 17010212												
Glacier Creek												
12	5259440	293570	12	5256280	292700	5	8	1992			Reichel and Genter 1993	
Lost Creek												
12	5307080	290830	12	5305580	287000	7	6	1993			Reichel and Genter 1994	
Swan River (tributaries covered separately)												
12	5246030	290960	12	5259840	297690	4	8	1992			Reichel and Genter 1993	4-5 August 1992
Lower Clark Fork River Drainage: 17010213												
Beaver Creek												
11	5286080	613090	11	5295050	609700	21	5	1988			Miller 1988	
11	5293130	609930	11	5295050	609700	24	7	1988			Miller 1988	
Big Beaver Creek												
11	5281140	601060	11	5285640	613770	1	6	1993	both		Reichel and Genter 1994	
Big Rock Creek												
11	5303840	649780	11	5303550	649260	9	6	1989			Miller 1989	
11	5303120	651890	11	5303550	649260	17	7	1989			Miller 1989	
Blue Creek												
Blue Creek, East Fork												
11	5328200	573710	11	5327410	572530	7	8	1988			Miller 1988	
11	5328200	573710	11	5327410	572530	7	6	1989			Fairman, Genter, and Miller 1989	
Blue Creek, West Fork												
11	5331830	570350	11	5330480	571290	7	8	1988			Miller 1988	
Bull River (tributaries covered separately)												
11	5338610	588070	11	5337600	584980	12	7	1988			Miller 1988	
11	5333200	584400	11	5319950	586150	2	8	1988			Miller 1988	
11	5324690	589180	11	5320500	586070	14	5	1989			Miller 1989	
11	5335080	584040	11	5329200	588650	24	6	1989			Miller 1989	
11	5321370	586530	11	5320500	586070	7	8	1989			Miller 1989	
11	5324690	589180	11	5320500	586070	1	8	1990			Fairman and Miller 1989	
Bull River, East Fork												
11	5330780	597610	11	5330130	592580	12	7	1988			Miller 1988	
11	5330780	597610	11	5330130	592580	2	8	1988			Miller 1988	
						7	6	1989			Fairman, Genter, and Miller 198	survey segment unknown

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code / Stream	Upper UTM		Lower UTM							#		
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type seen	Source	Comments
	11	5328850	590710	11	5330130	592580	6	5	1994		Reichel and Genter 1995	
Bull River, North Fork												
	11	5340550	589750	11	5339030	588550	11	7	1988		Miller 1988	
Bull River, South Fork												
	11	5334990	590380	11	5339030	588550	12	7	1988		Miller 1988	
Dry Creek												
	11	5333830	582720	11	5332880	584230	20	6	1990		Fairman and Miller 1990	
Elk Creek												
	11	5320010	578580	11	5322910	579620	26	7	1988		Miller 1988	
	11	5320010	578580	11	5322910	579620	26	6	1989		Miller 1989	
	11	5320010	578580	11	5322910	579620	7	8	1989		Fairman, Genter, and Miller 1989	
Elk Creek, East Fork												
	11	5313850	575670	11	5317640	575140	3	7	1988		Miller 1988	
							14	5	1989		Miller 1989	survey segment unknown
							26	6	1989		Miller 1989	survey segment unknown
							7	8	1989		Miller 1989	survey segment unknown
	11	5313850	575670	11	5317640	575140	13	6	1990		Fairman and Miller 1990	
	11	5313070	576030	11	5317640	575140	17	7	1990		Fairman and Miller 1990	
	11	5311130	577660	11	5308250	579250	2	7	1991		Merz 1991	
	11	5312060	576650	11	5308250	579250	4	8	1991		Merz 1991	
	11	5312060	576650	11	5308250	579250	22	8	1991		Merz 1991	
	11	5309950	578530	11	5313850	575670	13	5	1993		Reichel and Genter 1994	
Elk Creek, West Fork												
	11	5316950	572660	11	5317530	574980	2	7	1991		Merz 1991	
	11	5316950	572660	11	5317530	574980	4	8	1991		Merz 1991	
	11	5316950	572660	11	5317530	574980	22	8	1991		Merz 1991	
Fishtrap Creek												
	11	5290400	645340	11	5286020	645720	9	8	1988		Miller 1988	
	11	5297290	638840	11	5286020	645720	29	5	1989		Miller 1989	
	11	5303580	637070	11	5286020	645720	12	7	1989		Miller 1989	12-13 July 1989
	11	5297290	638840	11	5286020	645720	28	8	1989		Miller 1989	28-29 August 1989
	11	5293180	640220	11	5286020	645720	28	6	1990		Fairman and Miller 1990	28-29 June 1990
	11	5297290	638840	11	5286020	645720	6	8	1990		Fairman and Miller 1990	6-7 August 1990
Fishtrap Creek, West Fork												
	11	5296200	637580	11	5297320	638980	29	5	1989		Miller 1989	
	11	5296200	637580	11	5297320	638980	12	7	1989		Miller 1989	
Graves Creek												
	11	5286350	621690	11	5281950	619540	20	5	1989		Miller 1989	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code

Stream

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
11	5286760	622250	11	5281950	619540	6	7	1989			Miller 1989	
11	5286350	621690	11	5281950	619540	16	8	1989			Miller 1989	
11	5286350	621690	11	5281950	619540	26	6	1990			Fairman and Miller 1990	
11	5286760	622250	11	5281950	619540	26	7	1990			Fairman and Miller 1990	
11	5289480	626780	11	5281950	619540	8	7	1991			Merz 1991	
11	5286350	621690	11	5281950	619540	18	8	1991			Merz 1991	
11	5286350	621690	11	5281950	619540	6	8	1992			Reichel and Genter 1993	
11	5281950	619540	11	5286350	621690	14	5	1993			Reichel and Genter 1994	
Little Thompson River												
11	5287580	648740	11	5287870	647870	9	6	1989			Miller 1989	
11	5282570	653780	11	5287870	647870	19	7	1989			Miller 1989	
11	5282100	650340	11	5287870	647870	28	8	1989			Miller 1989	
Marten Creek												
11	5303900	583880	11	5303580	593570	19	6	1987		9	E. Crowe & E. Ash, pers. comm.	
11	5303900	583880	11	5303580	593570	18	6	1988		7	Miller 1988	
11	5303900	583880	11	5303580	593570	3	7	1988			Miller 1988	
11	5304780	589150	11	5303580	593570	25	7	1988			Miller 1988	
11	5304050	591450	11	5303580	593570	14	5	1989			Miller 1989	
11	5304050	591450	11	5303580	593570	6	6	1989			Fairman, Genter, and Miller 1989	
11	5304820	588310	11	5303580	593570	29	6	1989		1	Miller 1989	
11	5304780	589150	11	5303580	593570	11	8	1989		14	Miller 1989	
11	5304050	591450	11	5303580	593570	5	5	1990		1	Fairman and Miller 1990	
11	5304050	591450	11	5303580	593570	19	5	1990		3	Fairman and Miller 1990	
11	5304820	588310	11	5303580	593570	12	6	1990			Fairman and Miller 1990	12-13 June 1990
11	5303900	583880	11	5303580	593570	16	7	1990			Fairman and Miller 1990	16-17 July 1990
11	5304820	588310	11	5303580	593570	10	8	1990		4	Fairman and Miller 1990	
11	5303900	583880	11	5303580	593570	29	6	1991		3	Merz 1991	
11	5303900	583880	11	5303580	593570	3	8	1991			Merz 1991	
11	5303900	583880	11	5303580	593570	20	8	1991			Merz 1991	
11	5304820	588310	11	5303580	593570	1	6	1992			Reichel and Genter 1993	
11	5304550	586760	11	5303580	593570	4	8	1992		18	Reichel and Genter 1993	
11	5304140	584350	11	5303580	593570	13	5	1993		9	Reichel and Genter 1994	
11	5303900	583880	11	5303580	593570	26	5	1993		1	Reichel and Genter 1994	
11	5304140	584350	11	5303580	593570	2	6	1993		3	Reichel and Genter 1994	
11	5304300	585590	11	5303580	593570	29	7	1993		10	Reichel and Genter 1994	
11	5304550	586760	11	5303580	593570	4	5	1994		13	Reichel and Genter 1995	
11	5304820	588310	11	5303580	593570	29	7	1994			Reichel and Genter 1995	
Marten Creek, North Branch												

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code / Stream	Upper UTM		Lower UTM							#		
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type seen	Source	Comments
	11	5308020	582000	11	5303900	583880	1	7	1991		Merz 1991	
	11	5304540	583240	11	5303900	583880	3	8	1991		Merz 1991	
Marten Creek, South Fork												
	11	5299390	589410	11	5303120	592740	19	6	1987	16	E. Crowe & E. Ash, pers. comm.	
	11	5301550	591520	11	5303120	592740	13	6	1988	7	Miller 1988	
	11	5300920	590950	11	5303120	592740	25	7	1988		Miller 1988	
	11	5302010	592000	11	5303120	592740	14	5	1989	2	Miller 1989	
	11	5300920	590950	11	5303120	592740	29	6	1989	1	Miller 1989	
	11	5300090	590310	11	5303120	592740	11	8	1989		Miller 1989	
	11	5302010	592000	11	5303120	592740	5	5	1990		Fairman and Miller 1990	
	11	5299580	589690	11	5303120	592740	9	5	1990	2	Fairman and Miller 1990	
	11	5302010	592000	11	5303120	592740	19	5	1990		Fairman and Miller 1990	
	11	5301550	591520	11	5303120	592740	12	6	1990		Fairman and Miller 1990	
	11	5300920	590950	11	5303120	592740	16	7	1990		Fairman and Miller 1990	
	11	5298960	588470	11	5303120	592740	28	6	1991	3	Merz 1991	
	11	5300090	590310	11	5303120	592740	3	8	1991	5	Merz 1991	
	11	5300090	590310	11	5303120	592740	12	5	1992	6	Reichel and Genter 1993	
	11	5302010	592000	11	5303120	592740	1	6	1992		Reichel and Genter 1993	
	11	5301550	591520	11	5303120	592740	4	8	1992		Reichel and Genter 1993	
	11	5300090	590310	11	5303120	592740	13	5	1993	3	Reichel and Genter 1994	
	11	5300090	590310	11	5303120	592740	26	5	1993	4	Reichel and Genter 1994	
	11	5300920	590950	11	5303120	592740	2	6	1993	2	Reichel and Genter 1994	
	11	5300090	590310	11	5303120	592740	29	7	1993		Reichel and Genter 1994	
	11	5300090	590310	11	5303120	592740	4	5	1994	1	Reichel and Genter 1995	
	11	5300920	590950	11	5303120	592740	29	7	1994		Reichel and Genter 1995	
Marten Creek, South Branch												
	11	5302800	582670	11	5303900	583880	1	7	1991	2	Merz 1991	
	11	5303430	583300	11	5303900	583880	3	8	1991		Merz 1991	
McNeely Creek												
	11	5300700	589000	11	5300700	590780	28	6	1991	1	Merz 1991	
Napoleon Gulch												
	11	5328710	584990	11	5329250	585760	20	6	1990		Fairman and Miller 1990	
Pilgram Creek												
	11	5313720	589740	11	5316070	592020	26	7	1988		Miller 1988	
Prospect Creek												
							20	5	1989		Miller 1989	survey segment unknown
	11	5268640	616420	11	5271890	623470	3	7	1989		Miller 1989	
	11	5268940	618860	11	5271890	623470	16	8	1989		Miller 1989	

Appendix H. Harlequin Duck Surveys in Montana 1987-94

Drainage: Hydologic Code

Stream

Upper UTM			Lower UTM							#		
zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
11	5269540	620370	11	5271890	623470	14	8	1990			Fairman and Miller 1990	
Rock Creek												
						13	6	1988			Miller 1988	12-13 June 1988; survey
11	5319600	596510	11	5315120	596380	13	7	1988			Miller 1988	13-14 July 1988
						14	5	1989			Miller 1989	survey segment unknown
11	5319600	596510	11	5315900	596920	27	6	1989		2	Miller 1989	
11	5319600	596510	11	5315900	596920	8	8	1989			Miller 1989	
11	5321100	598210	11	5315900	596920	24	5	1990			Fairman and Miller 1990	
11	5319600	596510	11	5315120	596380	14	6	1990			Fairman and Miller 1990	
11	5320500	597450	11	5319600	596510	20	7	1990			Fairman and Miller 1990	
11	5320850	597950	11	5315120	596380	19	8	1990			Fairman and Miller 1990	19-20 Aug 1990
11	5321100	598210	11	5314070	593970	26	6	1991		1	Merz 1991	26-27 June 1991
11	5319600	596510	11	5314070	593970	17	8	1991			Merz 1991	
11	5320500	597450	11	5314070	593970	4	8	1992			Reichel and Genter 1993	1-5 Aug 1992
11	5320500	597450	11	5315120	596380	31	7	1993		7	Reichel and Genter 1994	
11	5319600	596510	11	5315120	596380	5	5	1994		7	Reichel and Genter 1995	
11	5320850	597950	11	5314070	593970	28	7	1994		4	Reichel and Genter 1995	
Swamp Creek												
11	5310850	605010	11	5307210	603130	12	6	1988			Miller 1988	
11	5312290	605330	11	5307210	603130	1	8	1988		1	Miller 1988	
11	5307950	603900	11	5307210	603130	20	5	1989			Miller 1989	
11	5310850	605010	11	5307210	603130	28	6	1989		12	Miller 1989	
11	5310850	605010	11	5307210	603130	10	8	1989		1	Miller 1989	
11	5307950	603900	11	5307210	603130	5	5	1990			Fairman and Miller 1990	
11	5307950	603900	11	5307210	603130	19	5	1990			Fairman and Miller 1990	
11	5310850	605010	11	5307210	603130	25	6	1990		2	Fairman and Miller 1990	
11	5313290	606010	11	5307210	603130	9	8	1990			Fairman and Miller 1990	
11	5313290	606010	11	5307950	603900	25	6	1991		8	Merz 1991	
11	5314140	606900	11	5308000	597900	11	8	1991			Merz 1991	
11	5312290	605330	11	5308000	597900	13	5	1992			Reichel and Genter 1993	
11	5310850	605010	11	5307210	603130	6	8	1992			Reichel and Genter 1993	
11	5313290	606010	11	5308000	597900	11	5	1993		2	Reichel and Genter 1994	
11	5314140	606900	11	5307210	603130	30	7	1993		3	Reichel and Genter 1994	30 Jul-2 Aug 1993
11	5312290	605330	11	5308000	597900	6	5	1994		1	Reichel and Genter 1995	
Thompson River (tributaries covered separately)												
11	5286020	645720	11	5270560	632440	8	8	1988			Miller 1988	8-9 May 1988
11	5286020	645720	11	5270560	632440	29	5	1989			Miller 1989	
11	5294020	649240	11	5270560	632440	9	6	1989			Miller 1989	

Appendix H. Harlequin Duck Surveys in Montana 1987-94.

Drainage: Hydologic Code / Stream	Upper UTM		Lower UTM							#		
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type seen	Source	Comments
	11	5287870	647870	11	5270560	632440	10	7	1989		Miller 1989	10-11 July 1989
	11	5282360	643570	11	5287870	647870	17	7	1989		Miller 1989	17-18 July 1989
	11	5287870	647870	11	5270560	632440	21	8	1989		Miller 1989	21-22 August 1989
	11	5305430	647240	11	5298790	648030	2	8	1990		Fairman and Miller 1990	
Thompson River, West Fork												
	11	5285860	634460	11	5278800	637200	8	8	1988		Miller 1988	
	11	5285170	634460	11	5278800	637200	29	5	1989		Miller 1989	
	11	5283190	634840	11	5278800	637200	10	7	1989		Miller 1989	
	11	5283190	634840	11	5278800	637200	21	8	1989		Miller 1989	
Trout Creek												
	11	5295870	597730	11	5298310	601600	28	5	1988		Miller 1988	
	11	5298310	601600	11	5299250	603180	24	7	1988		Miller 1988	
Trout Creek, East Fork												
	11	5293460	595740	11	5295230	596060	28	5	1988		Miller 1988	
Vermilion River												
	11	5303080	626200	11	5297700	609180	4	6	1988		Miller 1988	4-5 June 1988
	11	5300550	627200	11	5297700	609180	15	7	1988	7	Miller 1988	13-19 July 1988
	11	5300920	612000	11	5297700	609180	20	5	1989		Miller 1989	
	11	5301190	613820	11	5297700	609180	7	7	1989	8	Miller 1989	
	11	5303890	628010	11	5297700	609180	14	8	1989	13	Miller 1989	14-15 Aug 1989
	11	5300920	612000	11	5300100	610520	5	5	1990		Fairman and Miller 1990	
	11	5301050	613250	11	5300100	610520	19	5	1990	2	Fairman and Miller 1990	
	11	5301190	613820	11	5300100	610520	12	7	1990		Fairman and Miller 1990	
	11	5303890	628010	11	5300100	610520	16	8	1990	10	Fairman and Miller 1990	15-17 Aug 1990
	11	5293170	627350	11	5297700	609180	23	6	1991	2	Merz 1991	20-24 June 1991
	11	5303890	628010	11	5297700	609180	10	8	1991	1	Merz 1991	
	11	5303500	625300	11	5303890	628010	21	8	1991		Merz 1991	
	11	5302800	620650	11	5297700	609180	1	6	1992	2	Reichel and Genter 1993	1-2 June 1992
	11	5303890	628010	11	5297700	609180	6	8	1992		Reichel and Genter 1993	5-6 Aug 1992
	11	5296100	627350	11	5297700	609180	12	5	1993	5	Reichel and Genter 1994	
	11	5302800	620650	11	5297700	609180	27	5	1993	2	Reichel and Genter 1994	
	11	5297900	627370	11	5297700	609180	27	7	1993	9	Reichel and Genter 1994	27 July - 1 Aug 1993
	11	5300550	627200	11	5297700	609180	3	5	1994	5	Reichel and Genter 1995	
	11	5302800	620650	11	5297700	609180	29	7	1994	7	Reichel and Genter 1995	29-30 July 1994
Cataract Creek												
	11	5301040	615110	11	5301370	614700	17	7	1988		Miller 1988	
Happy's Gulch Creek												

Appendix H. Harlequin Duck Surveys in Montana 1987-9[illegible]

Drainage: Hydologic Code

Stream

Upper UTM zon	N/S utm	E/W utm	Lower UTM zon	N/S utm	E/W utm	Da	Mo	Year	Type	# seen	Source	Comments
11	5296570	626770	11	5296500	627300	19	7	1988			Miller 1988	
Miller Creek												
11	5298200	626340	11	5298070	627370	19	7	1988			Miller 1988	
Willow Creek												
11	5305010	628330	11	5303070	626170	20	6	1991			Merz 1991	20-24 June 1991
White Pine Creek												
11	5286040	597550	11	5289530	610640	21	5	1988			Miller 1988	
11	5289850	607160	11	5289710	611150	24	7	1988			Miller 1988	